RANCH DAY

OCTOBER 13, 1947

New Mexico Experiment Station, New Mexico Extension Service

Southwestern Forest and Range Experiment Station

Parasite Control Is Part of Good Ranching

Experimental Ranch

New Mexico College of A. and M. A.

Jornada Experimental Range

Southwestern Forest and Range Experiment Station

P R O G R A M

Ivan Watson, Extension Animal Husbandman, New Mexico Extension Service, Presiding

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LEAVE LAS CRUCES 8 a.m.

8:30 JORNADA HEADQUARTERS. Current Range Conditions on the Jornada - Fred N. Ares, Superintendent, Jornada Experimental Range.
Some New Information on Range Reseeding in New Mexico - J. O. Bridges, Forest Ecologist, Southwestern Forest and Range Experiment Station.

9:45 PASTURE 1 (College Ranch). Mesquite Invasion on the Range - J. J. Norris.

10:35 HEADQUARTERS. Practical Control of Cattle Grubs and Lice - Joe Whiteman, N. Mex. Extension Service.

11:30 Lunch -- Exhibit - Selecting Range Cows from First Year's Production - Marvin Koger in Charge.
12:45 Welcome -- H. R. Varney, Dean and Director.
Raymond Price, Director, Southwestern Forest and Range Experiment Station
12:55 Keeping up-to-date on Ranching Methods - Floyd W. Lee, San Mateo, President of Albuquerque Production Credit Association and N. Mex. Wool Growers' Association.
1:15 Progress of the Foot-and-Mouth Disease Campaign in Mexico - George A. Godfrey, Animas, N.Mex., Chairman Border States Foot-and-Mouth Disease Committee.
1:35 The National Beef Cattle Breeding Program - Dr. R. T. Clark, Coordinator Beef Cattle Breeding Program, U. S. Department of Agriculture.
1:55 Some of the Minor Minerals in New Mexico Range Grasses - W. E. Watkins.

2:25 CAMP WELL. Production of Range Cows as Influenced by Size and Type - Marvin Koger.
Supplements for Cows on Spring Range - J. H. Knox.

3:25 PASTURE 3. The Effect of the Pattern of Forage Utilization on Grazing Capacity - K. A. Valentine.

4:10 MAYFIELD WELL. A Comparison of Ten Years' Production from Range Cows and Yearling Steers - J. H. Knox.

JORNADA EXPERIMENTAL RANGE

JORNADA H.Q.

RINCON

West Well

Feeding corrals

Mayfield Well

Camp Well

Co'op Well

Mesquite Invasion Study

Seldon Well

Rodent Study

Mesquite Control

College H.Q.

Reseeding Area

South Well

12 COLLEGE RANCH

Summerford Mt.

RADIUM SPRINGS

LAS CRUCES

N

1 2 3 4 Miles

SECTION OF COLLEGE RANCH AND JORNADA EXPERIMENTAL RANGE SHOWING RANCH DAY ROUTE

Legend

Fence
Route
Boundary
Well
9 Pasture Number

CURRENT RANGE CONDITIONS ON THE JORNADA

By F. N. Ares

Your presence here today indicates your interest in the proper management and improvement of range lands, in the production of better livestock, and that you recognize the efforts being made on these experimental ranches to attain these objectives. It is generally admitted that long range planning for wise use of our public and private range lands is a matter of vital importance to southwestern economy; not only are stockmen affected but farmers and businessmen alike.

You have been on the Jornada since passing the stone monuments marking the entrance, about 10 miles south of here. Following this stop the route will turn southwest, traversing about 7 miles more of the Jornada range before crossing the boundary onto the College Ranch. Inasmuch as this year's tour will cover only a part of the 184,000 acres making up the Jornada it is appropriate to touch briefly upon the history and description of the Jornada Experimental Range as well as the aims and objectives of the work being carried on.

History

The Jornada was set aside by executive order of the President in 1912 for study by the Bureau of Plant Industry. In 1915 the Southwestern Forest and Range Experiment Station assumed responsibility for the experimental work. Throughout this period an unbroken series of livestock, vegetation, and climatic records have been collected and maintained in order to secure information that would be of value to the range livestock industry in the Southwest.

The area comprising the Jornada Experimental Range is considered typical of nearly 30 millions of acres in the more arid regions of the Southwest. The range and all improvements, such as fences, wells, surface tanks, and buildings, are owned by the Government. The cattle making up the experimental herd, however, have always been furnished by a cooperating stockman under agreement with the Secretary of Agriculture. A grazing charge is made for the use of the range. The present cooperator is Mr. B. A. Christmas, who is well known in the Southwest.

Description

The Jornada range is divided into seven large and two smaller experimental pastures on each of which daily stocking records are kept. These pastures roughly divide the range into the different forage types for grazing use at various seasons of the year. For example, the first pasture entered after crossing the Jornada boundary this morning consisted largely of tobosa and burrograss stands and as such makes up part of our summer-fall range, used for this period because these grasses are relished by cattle only through the growing season when they are green and succulent. At South Well, the first windmill south of here, you passed out of the summer range and into one of the black grama or yearlong pastures. As you know, black grama grass cures well on the stalk, is relished by cattle, and can be grazed yearlong if necessary. However, it is reserved on the Jornada as our winter-spring range because we found it highly desirable

to defer the use of black grama during the growing season. This system of use has proved the most beneficial to both range and livestock, and it is largely responsible for the good condition of the range in the pasture just traversed. For a contrast I wish that time would permit us to see some of the 80,000-acre pasture just east of here where black grama has been under yearlong use for over 30 years.

The range is watered by a system of deep wells on the yearlong range and surface water tanks on the summer or temporary range. The wells, seven in number, average about 350 feet in depth. The 14 large earthen tanks hold water several months and are supplemented by about 50 small tanks or water holes constructed on the summer range to aid in the distribution of livestock and bring about the full utilization of the temporary forage.

The Jornada is located in a low rainfall area, the average annual precipitation being only a little over 9 inches, over half of which comes during July, August, and September. Drought years are frequent. Most of the important range forage types of the semiarid Southwest are found within its boundaries, from the top black grama grass to the desolate mesquite-sand dune and the low value creosotebush types. Thus it can be said that the results of the experimental work carried on here have a wide application on similar ranges of the Southwest.

The grazing capacity of the Jornada, determined by study, range surveys, and by actual performance of the range under continuous use for the past 32 years, has been set at about 1,200 livestock on a yearlong basis. This means that the gross surface acre requirement of the range is about 160 acres per cow yearlong, or about 4 head per section. This is the average, of course; much of the range is inaccessible as is the case in our 40,000-acre mountain pasture and some of the range is so low in productivity that it will not support more than one cow to a section while other parts have a capacity of as high as 10 head or more per section.

Aims and Objectives

The principal objectives of the Jornada range research work have been to determine the grazing capacity of various range types and avoidance of the impacts of drought, to demonstrate improved methods of utilizing and managing range lands for livestock production, and to explore the possibilities of range improvement through noxious plant control and reseeding. To accomplish these management phases has called for the adoption and continued use of a carefully thought out plan of range management. As you know, conditions are ever changing so that there is a continuous need for studies not only to obtain long time trends but also to evaluate changes as they occur.

Conditions which called the experimental work into being over 30 years ago amounted almost to an emergency at that time. Severe losses of cattle were suffered in this part of the region from the frequent droughts; sometimes entire herds were wiped out in a single year. The average rate of increase was very poor; if the rancher got an average of 35 or 40 percent calf crop he was considered fortunate. The general grade of range livestock was unsatisfactory. Grade improvement of beef cattle types was

badly needed. Production costs were relatively high because of the necessity of frequent supplemental feeding to stave off starvation.

Proper stocking of the range was the most urgent problem and was attacked first. A plan of range management was gradually worked out which was especially designed to eliminate the heavy losses from drought, to permit the range to maintain itself in a high state of productivity, and to build up and improve the depleted or eroded areas already existing because of past overgrazing.

At the outset 4,000 cattle grazed on the Jornada. The numbers were reduced to 1,600 in 1925, and this figure continued in use until 1937 after which the numbers were again adjusted downward to about 1,200 head yearlong, the present numbers grazed. The extreme range of these adjustments over the years was necessary because at the outset of the study there existed little or no range or livestock data on southwestern ranges by which standards of proper stocking could be fixed. As the years passed, information had to be gained slowly through experience, vegetation records, livestock records based on actual use, and other means including the actual performance of the range over the years, including good as well as poor years of rainfall.

With reduced stocking of the range effected, a number of the other things plaguing the enterprise automatically cleared up. For example, death losses ordinarily running from 10 percent on up were reduced to 2 percent average during the first 20 years of the study; these were further reduced to 1 percent for the later period up to the present. Calf crops increased to 65 percent the first 9 years to 77 percent for the following 12 years. During the past 10 years the annual average calf crop has been 84 percent. Production costs were also substantially lowered because the new conservative stocking policy practically eliminated the need of supplemental feeding and the heavy expense connected with it. The use of better bulls resulting in further improvement of grade was initiated at the outset.

It has been fairly well demonstrated on the Jornada that once a plan for the proper stocking, management, and control of the range and livestock is worked up and followed consistently, a lot of the troubles which harass the cattleman will take care of themselves.

The casual observer may gain the impression in looking over the Jornada range that forage is wasted, that the grass is let grow because it is good to see it waving in the breeze. This is not the case. The forage on the stalk will furnish the winter grazing. Production records show that the Jornada has raised and marketed every year for the past 9 years an average of 409,000 pounds of beef on the hoof, which is greater than during the previous 12-year period when more cattle were run. The stocking and management plan used on the Jornada requires in average years that part of the current forage growth be left on the ground at the end of the grazing season. This carryover, far from being wasted, is considered as so much "grass in the bank" as far as the operator is concerned in that it can be used as roughage with supplemental feed in case of severe droughts. For the benefit of the range it can also be considered the same in that it constitutes a reserve of plant vitality which can be drawn upon in case of emergency such as drought or temporary overuse. At all times the decaying

grass litter serves to protect and hold the soil in place, and adds the all-important humus to enrich the soil.

Current Forage Conditions

Rainfall during the past summer has not been especially favorable for range forage production. In fact two months ago we were concerned over whether or not we would have an adequate forage crop and it looked like the beginning of another 1934 drought. Rainfall was deficient clear through the spring and early summer months. It was not until the middle of August that rainfall was sufficient to promote grass growth. Average rainfall during the latter part of August was about 2½ inches and was well timed and distributed. The forage growth that you will see on the tour we estimate to be about an average forage crop. This will have to carry us through until the middle of July next year. It is the near drought years such as this that impress one with the need for carrying over reserve forage so that the livestock will not suffer. Then, too, we have noted in these conservatively used pastures that the forage plants are able to make more rapid and greater volume growth, even with limited rainfall, than is the case in the more heavily grazed areas.

These facts should be kept in mind as the caravan leaves this stop and traverses the remainder of the route lying across the Jornada.

SOME NEW INFORMATION ON RANGE RESEEDING IN NEW MEXICO

By J. O. Bridges

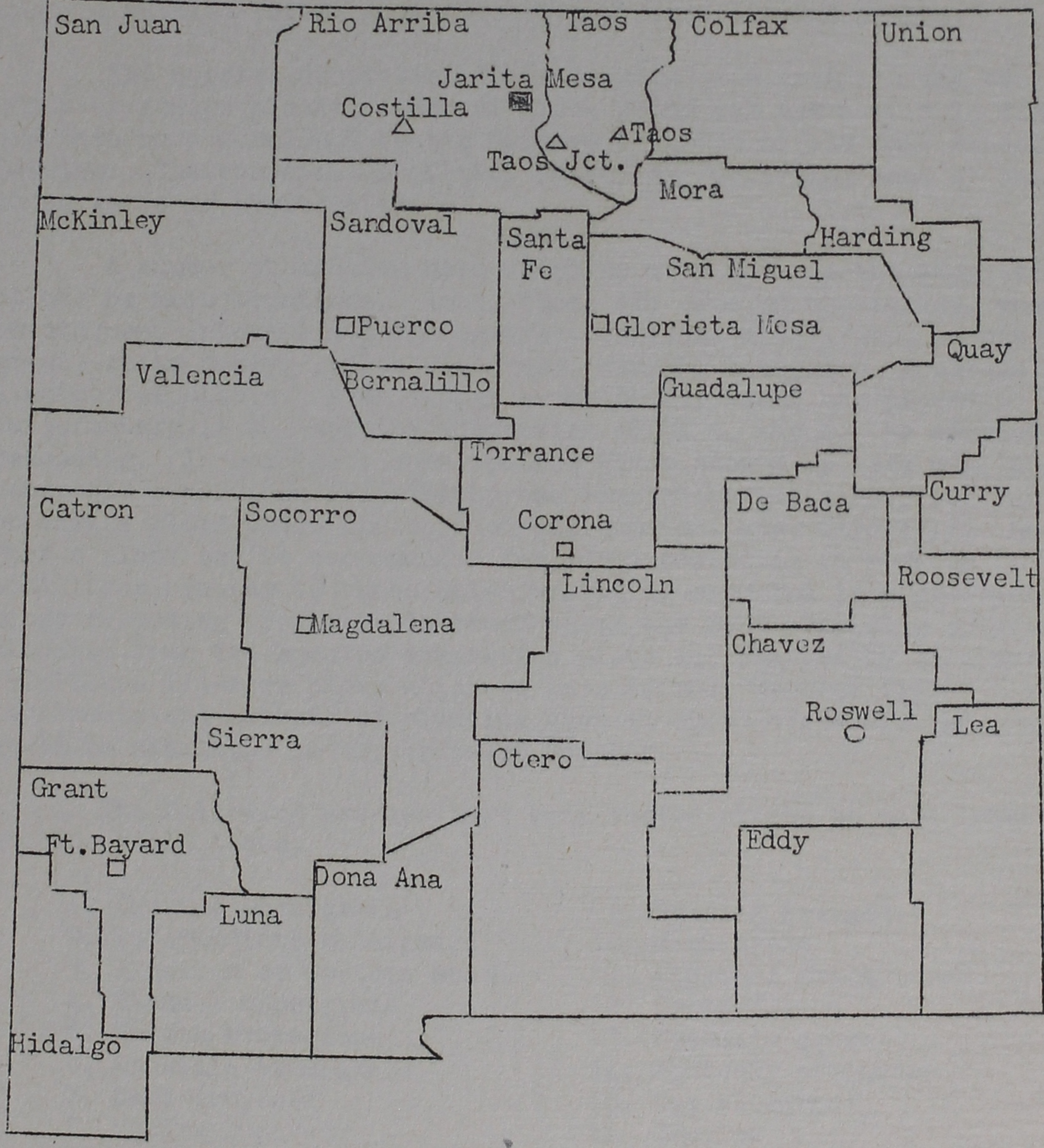
The present range reseeding research program of the Southwestern Forest and Range Experiment Station was begun in July of 1945. At that time there was the choice of trying to select a single location comprising a range of conditions representative of most of New Mexico and concentrating all the work there, or of locating the experimental plantings at several different sites over the State. The latter course was chosen and we now have experimental work covering various phases of range reseeding at ten different locations in New Mexico.

These locations are marked by the colored squares on the map. It will be noted that the study area locations are fairly well distributed over the State, geographically. This, however, was not the basis on which their locations were selected. For example, although other considerations entered in, the plot near Magdalena was selected primarily because many thousands of acres in west central New Mexico--similar to the plot site in rainfall and general climatic conditions--are not producing as much forage as they should and there appears to be a good possibility for improving the range forage. The plot on the middle Rio Puerco drainage was selected mainly because that area in general has a high potential for producing silt. Also, recent surveys show that the Rio Puerco is moving large quantities of silt into Elephant Butte reservoir. Successful reseeding would alleviate some of this menace. The plot on Jarita Mesa in the San Juan Mountains was selected primarily because this area has a large number of directly dependent local people who are in immediate need of improved forage for livestock for relief from their present economic conditions. Other plots were selected because they were representative of areas where there is a serious shortage of early spring forage, or because they are areas of high water-yielding capacity.

In the same way, experimental work in some areas of the State has been purposely deferred. For example, little work is being done in the southern or eastern portions of the State because it is felt that the necessary information will come from experimental work already being conducted in those sections.

In carrying on the experimental work it has been found desirable to devise a number of different kinds of test plots. The initial tests are conducted on what has been termed "adaptation plots." In this type of plot, which is illustrated by the grass garden at the Jornada Experimental Range, the competing natural vegetation is eliminated and each species is hand planted in three rows 1 foot apart and 12 feet long. In all species adaptation plots room is provided for duplicate plantings of 200 different plants. At the Jornada grass garden the primary interest was to get 100 species of grass growing together for demonstration purposes, and in order to insure a stand, artificial watering has been resorted to. Ordinarily, however, the purpose of the adaptation plots is to find out which plants will germinate and grow under natural rainfall and other climatic conditions, but free from competition of other vegetation. If of 200 species planted, 25 germinate, live, and reproduce themselves, it is assumed that

RANGE RESEEDING STUDY AREAS - NEW MEXICO



Vegetation Zone

- □ Woodland
- ■ Open pine
- △ Sagebrush
- ○ Shortgrass plains

these are adapted and that the other 175 are unsuited to the particular climate and soil where the test was made. Usually a species will be planted at least three times before being considered not adapted to a site.

A species adaptation study has been installed at each of the 10 locations shown on the map. At three locations this is the only type of study so far installed. This is the case on the middle Rio Puerco at the site near Roswell and at Silver City. At these sites not much is known about which species will be suitable and results from the adaptation tests must be awaited before more extensive studies are undertaken.

The species adaptation tests require seed from a great many different kinds of forage plants. Most of these seeds are not available commercially and have been furnished by the Nursery Division of the Soil Conservation Service. The cooperation of that agency in furnishing many of the seeds for these tests is appreciated.

A number of species have shown up very well in the adaptation tests at one or more locations. Among these are crested wheatgrass, western wheatgrass, intermediate wheatgrass, beardless wheatgrass, smooth brome grass, spike muhly, Indian ricegrass, weeping lovegrass, mountain rye, and a number of others. Even though a particular plant has proved to be very satisfactory in the species adaptation plots it may not be adapted to range reseeding. In our tests some species which showed up very well under the favorable conditions afforded by the adaptation plots have not done well on larger plots where the seedbed was somewhat less favorable. Hence, before a plant can be recommended for range reseeding it must be tested under conditions similar to those which are to be expected in a practical scale range reseeding project. In these tests the most promising species are selected from the species adaptation plots and planted by machinery on triplicate 1/4-acre plots which we have termed "Species Yield" plots. The implements and methods of planting used in these tests are those which would be available to the ordinary rancher.

The following species have been tested at one or more locations in species yield tests.

1. Crested wheatgrass
2. Intermediate wheatgrass
3. Bluestem or western wheat
4. Slender wheatgrass
5. Smooth bromegrass
6. Mountain bromegrass
7. Sand dropseed
8. Meadow fescue
9. Weeping lovegrass
10. Blue grama
11. Sideoats grama
12. Orchardgrass
13. Michel's grass
14. Kentucky bluegrass
15. Big bluegrass
16. Chamiza

At an elevation of 7,400 feet in the woodland type, crested wheatgrass, bluestem or western wheatgrass, and intermediate wheatgrass have produced good stands and a fair volume of growth with 12 inches of rain. Bluestem is the most drought resistant of the three but is also the lowest producer and the poorest in palatability. Crested wheatgrass is the best forage producer and is slightly more drought resistant than intermediate wheatgrass. It also has the best palatability. However, crested wheatgrass

does have certain limitations. At the plot near Corona, also in the woodland type where the elevation is 6,500 feet and the yearly precipitation approximately 12 inches, it is not very promising. This year it did not produce much spring growth and since the summer rains began the native turf is out-producing it. Crested wheatgrass does not respond well to hot weather, and apparently in New Mexico should receive 14 inches or more of annual rainfall in order to make good growth.

Smooth bromegrass, mountain bromegrass, orchardgrass, and meadow fescue are doing very well at one location in the pine-bunchgrass type where the annual rainfall is over 20 inches. At another location where the rainfall is 16 inches they are not doing so well. The answer in this case appears to be that these grasses are not suited to localities receiving less than 20 inches of annual rainfall.

In our plantings blue grama, sideoats grama, and weeping lovegrass have not proved to be very successful for one reason or another. However, these three grasses have become more or less standard species for reseeding in the eastern plains area of the State. In that section of the State, ranchers have successfully reseeded many thousands of acres to these three grasses. It is presumed at this stage of our work that the portions of the State where our plots are located conditions are either too dry or too cold, or both, for these three grasses to do well. Future studies may show that they can be grown under certain situations. For example, it may be found that in the warmer part of our area weeping lovegrass may do very well in swales or on other sites that receive additional moisture.

Michel's grass yields well if the stand is once established but so far only poor stands of this highly advertised grass have been obtained. Also it is not a perennial grass and thus is not very desirable for range reseeding. Sand dropseed nearly always produces an excellent stand even in dry situations. However, the stand is slow to develop and it is not a heavy yielder. Sand dropseed seems to have a place in reseeding but probably should be used only in mixtures with other species.

At the site which receives more than 20 inches of rainfall, Kentucky bluegrass, slender wheatgrass, and big bluegrass have also been planted. The big bluegrass is growing very well and is yielding practically as much forage as crested wheatgrass. Indications are that it may be successful under lower rainfall conditions. The Kentucky bluegrass has established an excellent stand but on a yield basis is less than 1/5 as valuable as crested wheatgrass. The slender wheatgrass has an excellent stand but as yet is not yielding very much forage. However, it is better than Kentucky bluegrass in this respect.

Results with chamiza have been erratic. In some cases it germinates readily and makes a rapid growth. In other cases the seedlings have been difficult to get started. At one location a good stand of chamiza has been obtained under a rainfall of 12 inches.

The development of practical effective methods of soil preparation is another very important phase of range reseeding. Two major experiments of this kind have been installed in sagebrush areas and two in blue grama

sod areas. To date, six different methods of soil preparation have been used in each of the two cover types.

Methods which have been tried for clearing sagebrush include railing with heavy railroad irons, blading the brush off in strips on the contour with a road grader, plowing with a heavy disk plow, and plowing with the wheatland or one-way disk plow. Partial clearing of the sagebrush by use of a heavy spiked roller, developed by the Division of Grazing, and by plowing furrows on the contour at 5-foot intervals has also been tried. In these tests the heavy disk plow did the best job of ridding the land of brush. The wheatland plow was slightly less satisfactory in this respect, but was about twice as efficient in the use of power as the heavy disk plow.

Railing with a heavy A-type rail took out most of the sagebrush and did not disturb the native grasses, indicating that railing would probably be the best method to use where there is a fairly good cover of desirable forage grasses.

The road grader did a good job in removing sagebrush but was very inefficient in the use of power. The spiked roller was almost as good as the rail but is harder to build and was not as efficient in the use of power. Plowing on the contour was the poorest method tested.

On blue grama sod, as in the sagebrush areas, we have tried the heavy disk plow and the wheatland plow for preparing a seedbed. In addition the light tandem disk, the heavy offset tractor disk, the Graham-Hoeme plow, the Ford-Ferguson tiller, and listing on the contour at 5-foot intervals were also tested.

Here again the heavy disk plow gave the best results so far as cutting up the sod was concerned. The Graham-Hoeme plow did almost as well as the heavy disk plow and was considerably more efficient in the use of power. Both the wheatland plow and the tandem disk harrow did a very poor job of seedbed preparation. This was also true of the Ford-Ferguson tiller when equipped with the cutting points furnished by the manufacturer. A single disking with the heavy offset disk did not produce the desired results. Twice over with this disk did a good job but made the method too inefficient in the use of power.

Listing on the contour at 5-foot intervals appears to be a good method for use in blue grama sod areas. A fair stand of crested wheatgrass has been produced by this method and, as a result of better moisture retention, the native grass that remained made over twice the growth of that on undisturbed areas.

With regard to equipment, a few works of explanation about the Graham-Hoeme plow and the Ford-Ferguson tiller are in order. The Graham-Hoeme plow was furnished us free of charge by the Graham-Hoeme Plow Company of Amarillo, Texas, for experimental use. As indicated previously, it did a very nice job in breaking up the blue grama sod. However, the shovels furnished by the manufacturer were designed for use on grain stubble and are too light for use on unplowed range land. It is believed that if the shovels were made smaller and much heavier, which would require more of

them, this plow would be a very efficient implement to use in preparing sod land for grass seeding.

The Ford-Ferguson tiller comes equipped with narrow points or chisels designed for deep tillage in orchards or gardens. It was found that when this tiller is fitted with shovels it also does satisfactory work on blue grama sod, the job being quite similar to that obtained with the Graham-Hoeme plow.

Several methods of planting were tried on each of the different methods of seedbed preparation. These included drilling with a single disk grain drill and with the special grass drill developed and used by the Soil Conservation Service. A cultipacker seeder constructed by the experiment station was also used in several tests. Broadcasting of seed was also tested in conjunction with several methods of covering after broadcasting, including harrowing with a spike tooth harrow, single disking, and cultipacking. These tests showed that in loose sandy soil the cultipacker seeder and cultipacking after broadcasting were very satisfactory. On heavier soils drilling with a grain drill was the best method. The grass drill seems to be best where chaffy seed material is used but where the seed is clean, as in the case of crested wheatgrass, the single disk grain drill was more satisfactory.

Successful range reseeding also involves getting the seed in the ground at the proper time to make best use of the soil moisture. A seasons-of-planting study was started last April at two different locations. It is too early to form definite conclusions from the results obtained but it was noted that after the summer rains, which came in August, the July plantings of all 20 species used were up in almost perfect stands. The April plantings of the same species on the same area either germinated very little or not at all. Seeds planted in September have all germinated well but the plants are small and there is some question as to whether they will survive the winter and next summer's drought. At our study areas, as is true in all but the eastern third of New Mexico, a high percentage of the yearly rainfall occurs during the summer months. Consequently we feel that the July plantings have the greatest chance for success.

One of the major points to be considered in selecting a plant for reseeding is its ability to stand up under grazing. We have not as yet conducted grazing tests on reseeded stands but hope to in the near future. From general observation and on the basis of studies in other regions total protection from grazing during the first year after planting and until the end of the growing season the second year is recommended. The reseeded area may then be grazed lightly. After the end of the third growing season it should be able to stand full use. By full use is meant proper use for the species concerned. On some species like Kentucky bluegrass this may mean grazing to a height of 1 inch whereas on less resistant plants like Arizona fescue it will mean leaving a stubble of 6 inches. Most other species fall between these two extremes.

A summary of the salient points in range reseeding is given below:

1. Plant only those species known to be adapted to the site.

2. Prepare the seedbed by the most economical method that will assure success. A wheatland plow is recommended for sagebrush land. A heavy disk plow is best on sod lands, but either the Graham-Hoeme plow or the Ford-Ferguson tiller is satisfactory if fitted with suitable shovels.

3. On heavy clay and clay loam soils plant with a drill if possible. If no drill is available the seed may be broadcast and covered with a spike tooth harrow or disk harrow. On sandy soils covering the seed with a cultipacker is recommended.

4. Don't plant the seed too deep. One-half to one inch is best for most grass seeds but extremely small seeds such as those of the lovegrasses should be planted at only 1/4 to 1/2 inch.

5. Plant sufficient seed to secure a full stand. The amount of seed required will vary from 1-1/2 pounds per acre with the lovegrasses to 10 to 12 pounds with large seeded species such as some of the bromegrasses and wheatgrasses.

6. Plant during late June or early July if possible, otherwise plant during early fall. Spring appears to be the poorest time to plant grass seed.

7. Don't graze the reseeded stand until the end of the second growing season.

MESQUITE INVASION ON THE RANGE

By J. J. Norris

Steadily increasing amounts of shrubs of low palatability on rangeland in the Southwest have become an important problem facing the range industry. Mesquite is but one of the several undesirable shrubs which is supplanting the valuable forage species. In some areas its rate of spread into grassland is so slow as to pass unnoticed for years or else to cause little concern; while in other areas the spread may go on at a fairly rapid rate.

In order to determine the rate of mesquite invasion into our grassland, a study was initiated here on the College Ranch in 1940. A belt transect 1 rod (16-1/2 ft.) wide and 203 rods (3,349-1/2 ft.) long was established in this area extending from the mesquite sand dunes out into the grassland beyond the mesquite zone. This transect was divided into plots 1 rod square and the crown spread in square feet of each mesquite plant appearing in the plots was charted to scale. The first charting was done in the summer of 1940. The second charting was completed in August 1947, 7 years later. To facilitate study of the data this transect was divided into two halves, one of which was from the mesquite dune area to the edge of the mesquite type with the other half of the transect lying in the grassland type. Study of these data brings out some rather surprising information and also paints a somewhat gloomy picture for those of us who may have been discrediting the invasion of mesquite into grassland. The data are presented in the following table:

Table 1.

	1940	1947	Increase 1940-1947	1/ Dead plants	Increase per acre
Half of transect in mesquite type					
Number of plants	81	173	92	2	145
Total crown spread, sq.ft.	1451.0	2626.25	1175.25	-	1861.6
Half of transect in grassland					
Number of plants	72	155	83	9	129
Total crown spread, sq.ft.	415.5	723.5	308.0	-	483.2
Total transect					
Number of plants	153	328	175	11	137
Total crown spread, sq.ft.	1866.5	3349.5	1483.0	-	1168.0

1/ Plants charted in 1940 not appearing in 1947.

The most remarkable fact about these figures is the number of new mesquite plants which have appeared during the 7-year period. This is true in both the mesquite type and in the grassland and the number of plants has more than doubled in each case. A small part of this is due to previously established plants extending their crown spread into the transect; however, careful study of the charts shows only seven plants of this nature. From the death loss column it is readily evident that the increase in new plants has not been compensated for by die out during the period of study. The majority of these new

plants are small ones which the casual observer might easily overlook. However, they are present and each one is likely to increase its size, replacing valuable forage plants and setting the stage for the conversion of this grassland into worthless dune areas.

The line of figures showing total crown spread in square feet presents much the same sort of a picture except that the percent of increase is not so large. Spread of mesquite on each half of the transect has increased by about three quarters in each case. Crown spread does not give the entire story. The effect of the mesquite root system in reducing surrounding desirable vegetation may be much greater. Then too, we must not overlook the fact that mature mesquite plants offer conditions favorable for the formation of dunes resulting in the loss of practically all desirable plants.

What, then, does mesquite invasion of ranges mean in terms of production? A survey of all vegetation, exclusive of mesquite, on each plot in this transect was carried out by means of a reconnaissance estimate at the time of the charting. Comparison of the averages on the two halves of the transect shows that the stand of vegetation, excepting mesquite, on the grassland was over one and one-half times as great as that on the mesquite type. Difference between the two types is also reflected in composition of desirable plants. Black grama, dropseed, and threeawn grasses make up 93 percent of the vegetation in the grassland type as compared to 58 percent in the mesquite type. Converting these figures to carrying capacity shows that the grassland will carry over three and one-half times as many animal units per section as the mesquite country. This means that we stand to lose a big share of over-productive capacity if the mesquite continues to advance.

The next question is what to do about it. Proper management with conservative grazing apparently isn't the answer as is shown in this pasture. Here grazing use has been moderate, 25.6 cattle year long for the past 10 years. That amounts to about 6.7 head per section and still the mesquite has advanced.

Various control methods have been tested throughout the Southwest with results ranging from poor to fairly good; however, cost is normally the limiting factor. I will not go into detail on any of these methods, but a mention of the more satisfactory ones might be worth while.

The use of kerosene and other oils applied to the base of mesquite plants gives good results if properly applied. Proper application means the use of sufficient oil to thoroughly wet the zone of dormant buds which may be at various depths below the surface. This treatment can be quite effective on the tree type of mesquite but is not practical on the dune forming type. Sodium arsenite has given the best results of various chemicals tested. However, it is poisonous to man and animal and considerable care must be exercised in its use.

Power grubbing has been tested in a number of areas and if properly done yields good results. Its best application appears to be in heavy stands of larger mesquite plants, but the cost is usually rather high and oftentimes destruction of other vegetation opens the way for serious erosion. Continued experimentation with grubbing machinery may develop equipment which will reduce the cost and do a better job. Hand grubbing is recommended in young stands where the plants are small and also for clean-up work after power grubbing or other treatment. Our limited work on hand grubbing indicates that it is satisfactory on stands of about 15 plants per acre. However, as the number of plants increase the cost will become correspondingly higher. In stands of 10 plants per acre we figured that a man could do about 25 acres per day. Stands of around 50 plants per acre reduced the daily acreage to about 6, while stands such as this one are out of the question with hand grubbing. Where hand grubbing will pay is in removing small plants in early stages of mesquite invasion.

Chemical treatments with various commercial weed killers have not been adequately tested. Results to date are not particularly promising; however, further developments may prove valuable. We have just initiated a project designed to test any promising control methods; however, it is too early to say much about this.

Going back to the invasion problem, it might be well to say that this single transect study doesn't give all the answers. All it shows is that the mesquite has increased greatly here during the last 7 years. The effect of such factors as climate, soil, rate of growth, and pasture management have not been adequately studied. We are working on these and other problems in an effort to learn how they affect invasion and to work out satisfactory control systems. The apparent fact is that the stage is now set in this location for complete domination of the pastures by mesquite unless we stop it.

SOME OF THE MINOR MINERALS IN NEW MEXICO RANGE GRASSES

By W. E. Watkins

A shortage of iron, cobalt, and copper has caused certain kinds of anemias in livestock. When deficient areas have been found in certain states and foreign countries, the question arises as to what is the situation in New Mexico with respect to some of the minor minerals which the animal body needs.

Some of the elements needed by the animal body besides common salt, calcium, and phosphorus are iodine, iron, copper, sulphur, potassium magnesium, manganese, zinc, fluorine, and cobalt.

It is only in recent years that some of these elements have been found necessary for certain animals and for many minerals the requirements have not been fully studied. For with most of these elements mere traces or only a few parts per million furnish adequate amounts for animal life. The analyses of the forage grasses and browse for these minor elements provide an effective way of finding areas deficient in these elements.

During the last 3 years the Regional U. S. Plant, Soil, and Nutrition Laboratory, located at Ithaca, New York, has cooperated with this department and has analyzed over 100 samples of grasses from 14 different areas of New Mexico. These analyses have included phosphorus, cobalt, copper, manganese, and zinc on part of them.

These samples which were analyzed by the Regional Laboratory were described by them as being normal when compared to grasses of healthy areas. An exception to this was the manganese values which were on some of the grasses taken from the College Ranch, which were lower than some, but not extremely low. The balance of the samples were high in manganese. However, manganese seems to be a required element mainly concerned with poultry.

The phosphorus determinations vary considerably. The highest phosphorus values are found in September and October, while the samples taken in March are quite low and show the effect of wintering and leaching. There is only one area in which the cobalt approached the low value and that was on grass other than blue grama. One year several low values for copper were found on this ranch, while the next year on the same plot and the same plants the copper was over twice as high.

Cobalt stimulates red blood cell formation and growth of the young. Cobalt assists in the utilization of iron in cattle and sheep. The symptoms of cobalt deficiency are the same as for bad nutrition or food shortages. The affected animals wither away and die; therefore, the problem is acute in areas where a deficiency occurs. A recent book by Maynard of Cornell gives a chart which shows no cobalt deficient areas west of the Mississippi River. He further adds, "there seems to be no justification on the basis of present evidence for the addition of cobalt supplements to rations generally where no need has been demonstrated."

ANALYSES OF GRASSES FOR TRACE MINERALS

By U. S. Plant, Soil, and Nutrition Laboratory - Ithaca, N.Y.

Sample number	Grass	Location	Date collected	Phosphorus Pct.	Manganese (1) p.p.m.	Cobalt (2) p.p.m.	Copper (3) p.p.m.	Zinc (4) p.p.m.
1-6	Tobosa	College Ranch, Pasture 6	Aug.30,44	.17	106	.12	7.8	35.1
25-30	"	" " " "	Mar. 5,45	.092	94	.10	8.7	26.1
7-12	Mesa dropseed	" " " 12	Sep.11,44	.142	24	.10	5.6	22.9
73-78	" "	" " " "	Oct.29,45	.117	37	.09	14.0	
31-36	" "	" " " 12	Mar. 5,45	.038	29	.15	11.2	17.4
13-18	Black grama	"Summerford Mt.	Oct.23,44	.155	27	.10	5.2	21.7
79-84	Black grama	" " " "	Oct.29,45	.085	34	.12	12.3	
37-42	" "	" " " "	Mar. 5,45	.080	33	.15	10.6	23.2
19-24	" "	" " Pasture 2	Oct.23,44	.090	31	.15	6.2	20.5
43-48	" "	" " " 2	Mar. 5,45	.057	28	.17	9.3	18.9
49-54	Arizona fescue	Jarita Mesa, Taos	Oct. 2,45	.118	72	.20	7.3	
55-60	Blue grama	East Mesa, Las Vegas	Oct. 3,45	.124	50	.13	16.1	
61-66	Blue grama	Tucumcari Field Station	Oct. 3,45	.147	31	.11	12.3	
67-72	Blue grama	2 mi. N Clovis	Oct. 5,45	.157	49	.22	15.1	
85-88	" "	Luna, near Blue River	Nov.16,45	.106	23	.14	11.6	
89-90	" "	Kingston	Nov.23,45	.096	24	.18	15.7	
93-95	" "	McMillan Silver City	Oct.19,46	.132	62	.16	9.5	
96-98	" "	Fort Bayard	Oct.19,46	.126	47	.13	22.7	
99-101	Dropseed	Culbertson 3 mi.E.Lordsburg	" 20,46	.049	39	.22	8.6	
102-104	Sideoats grama	Eweing 8 mi.S.Lordsburg	Oct.20,46	.114	49	.08	11.6	
105-107	Andropogon scoparius	8 mi. S. Hobbs	Oct.26,46	.065	40	.06	8.3	
108-110	Blue grama	Near Hobbs Air Field	Oct.26,46	.234	55	.10	13.0	
111-113	" "	Joel Burns, Lovington	Oct.26,46	.194	44	.08	10.2	

(1) p.p.m. - Parts per million.
(2) .04 to .07 parts of cobalt per million is considered low.
(3) Copper with 7.5 parts per million is considered adequate.
(4) Zinc with 20 parts per million is considered an excess.

ANALYSES OF GRASSES FOR TRACE MINERALS

W. J. Pierce, Soil and Animal Nutrition Laboratory - Ithaca, N.Y.

Sample number	Grass	Location	Date	Phos- (1)	Manganese (2)	Copper (3)	Zinc (4)
1-8	Timothy	College Ranch, Tompkins Co.	May 24,'42	1760.	47	6.2	25.4
9-14	"	" " "	" " "	1780.	54	8.4	28.6
15-20	"	" " "	" " "	2210.	48	7.2	24.8
21-26	"	" " "	" " "	2240.	42	6.8	26.2
27-32	"	" " "	" " "	2180.	38	5.6	22.4
33-38	"	" " "	" " "	2260.	44	6.4	24.6
39-44	"	" " "	" " "	2310.	46	6.8	25.8
45-50	"	" " "	" " "	2290.	45	6.6	25.2
51-56	"	" " "	" " "	2340.	48	7.0	26.4
57-62	"	" " "	" " "	2360.	49	7.2	27.0
63-68	"	" " "	" " "	2380.	50	7.4	27.6
69-74	Alsike Clover	" " "	" " "	2420.	52	6.8	28.4
75-80	"	" " "	" " "	2440.	54	6.6	28.8
81-86	"	" " "	" " "	2460.	56	6.4	29.2
87-92	"	" " "	" " "	2480.	58	6.2	29.6
93-98	"	" " "	" " "	2500.	60	6.0	30.0
99-104	Alsike Clover	Lamont, Nest Blue Mixed	Nov.12,'42	2080.	54	7.2	26.8
105-110	Timothy	" " "	" " "	2120.	52	6.8	25.6
111-116	Alsike Clover	Lamont, Nest Blue Mixed	Nov.12,'42	2060.	56	7.4	27.2
117-122	Timothy	" " "	" " "	2100.	54	7.0	26.0
123-128	Alsike Clover	Ithaca, Triangle Field	May 20,'43	2340.	62	8.2	30.4
129-134	Timothy	" " "	" " "	2380.	60	7.8	29.2
135-140	Alsike Clover	Ithaca, Triangle Field	May 20,'43	2360.	64	8.4	31.0
141-146	Timothy	" " "	" " "	2400.	62	8.0	29.8
147-152	Alsike Clover	Ithaca, Triangle Field	May 20,'43	2380.	66	8.6	31.8
153-158	Timothy	" " "	" " "	2420.	64	8.2	30.6
159-164	Alsike Clover	Ithaca, Triangle Field	May 20,'43	2440.	68	8.8	32.6
165-170	Timothy	" " "	" " "	2460.	66	8.4	31.4
171-176	Alsike Clover	Ithaca, Triangle Field	May 20,'43	2480.	70	9.0	33.4
177-182	Timothy	" " "	" " "	2500.	68	8.6	32.2
183-188	Alsike Clover	Ithaca, Triangle Field	May 20,'43	2520.	72	9.2	34.2
189-194	Timothy	" " "	" " "	2540.	70	8.8	33.0
195-200	Alsike Clover	Ithaca, Triangle Field	May 20,'43	2560.	74	9.4	35.0
201-206	Timothy	" " "	" " "	2580.	72	9.0	33.8
207-212	Alsike Clover	Ithaca, Triangle Field	May 20,'43	2600.	76	9.6	36.2
213-218	Timothy	" " "	" " "	2620.	74	9.2	34.6
219-224	Alsike Clover	Ithaca, Triangle Field	May 20,'43	2640.	78	9.8	37.0
225-230	Timothy	" " "	" " "	2660.	76	9.4	35.4
231-236	Alsike Clover	Ithaca, Triangle Field	May 20,'43	2680.	80	10.0	37.8
237-242	Timothy	" " "	" " "	2700.	78	9.8	36.8
243-248	Alsike Clover	Ithaca, Triangle Field	May 20,'43	2720.	82	10.2	38.6
249-254	Timothy	" " "	" " "	2740.	80	10.0	37.6
255-260	Alsike Clover	Ithaca, Triangle Field	May 20,'43	2760.	84	10.4	39.4
261-266	Timothy	" " "	" " "	2780.	82	10.2	38.4
267-272	Alsike Clover	Ithaca, Triangle Field	May 20,'43	2800.	86	10.6	40.2
273-278	Timothy	" " "	" " "	2820.	84	10.4	39.2
279-284	Alsike Clover	Ithaca, Triangle Field	May 20,'43	2840.	88	10.8	41.0
285-290	Timothy	" " "	" " "	2860.	86	10.6	40.0
291-296	Alsike Clover	Ithaca, Triangle Field	May 20,'43	2880.	90	11.0	41.8
297-302	Timothy	" " "	" " "	2900.	88	10.8	40.8
303-308	Alsike Clover	Ithaca, Triangle Field	May 20,'43	2920.	92	11.2	42.6
309-314	Timothy	" " "	" " "	2940.	90	11.0	41.6
315-320	Alsike Clover	Ithaca, Triangle Field	May 20,'43	2960.	94	11.4	43.4
321-326	Timothy	" " "	" " "	2980.	92	11.2	42.4
327-332	Alsike Clover	Ithaca, Triangle Field	May 20,'43	3000.	96	11.6	44.2
333-338	Timothy	" " "	" " "	3020.	94	11.4	43.2
339-344	Alsike Clover	Ithaca, Triangle Field	May 20,'43	3040.	98	11.8	45.0
345-350	Timothy	" " "	" " "	3060.	96	11.6	44.0
351-356	Alsike Clover	Ithaca, Triangle Field	May 20,'43	3080.	100	12.0	45.8
357-362	Timothy	" " "	" " "	3100.	98	11.8	44.8
363-368	Alsike Clover	Ithaca, Triangle Field	May 20,'43	3120.	102	12.2	46.6
369-374	Timothy	" " "	" " "	3140.	100	12.0	45.6
375-380	Alsike Clover	Ithaca, Triangle Field	May 20,'43	3160.	104	12.4	47.4
381-386	Timothy	" " "	" " "	3180.	102	12.2	46.4
387-392	Alsike Clover	Ithaca, Triangle Field	May 20,'43	3200.	106	12.6	48.2
393-398	Timothy	" " "	" " "	3220.	104	12.4	47.2
399-404	Alsike Clover	Ithaca, Triangle Field	May 20,'43	3240.	108	12.8	49.0
405-410	Timothy	" " "	" " "	3260.	106	12.6	48.0
411-416	Alsike Clover	Ithaca, Triangle Field	May 20,'43	3280.	110	13.0	49.8
417-422	Timothy	" " "	" " "	3300.	108	12.8	48.8
423-428	Alsike Clover	Ithaca, Triangle Field	May 20,'43	3320.	112	13.2	50.6
429-434	Timothy	" " "	" " "	3340.	110	13.0	49.6
435-440	Alsike Clover	Ithaca, Triangle Field	May 20,'43	3360.	114	13.4	51.4
441-446	Timothy	" " "	" " "	3380.	112	13.2	50.4
447-452	Alsike Clover	Ithaca, Triangle Field	May 20,'43	3400.	116	13.6	52.2
453-458	Timothy	" " "	" " "	3420.	114	13.4	51.2
459-464	Alsike Clover	Ithaca, Triangle Field	May 20,'43	3440.	118	13.8	53.0
465-470	Timothy	" " "	" " "	3460.	116	13.6	52.0
471-476	Alsike Clover	Ithaca, Triangle Field	May 20,'43	3480.	120	14.0	53.8
477-482	Timothy	" " "	" " "	3500.	118	13.8	52.8
483-488	Alsike Clover	Ithaca, Triangle Field	May 20,'43	3520.	122	14.2	54.6
489-494	Timothy	" " "	" " "	3540.	120	14.0	53.6
495-500	Alsike Clover	Ithaca, Triangle Field	May 20,'43	3560.	124	14.4	55.4
501-506	Timothy	" " "	" " "	3580.	122	14.2	54.4
507-512	Alsike Clover	Ithaca, Triangle Field	May 20,'43	3600.	126	14.6	56.2
513-518	Timothy	" " "	" " "	3620.	124	14.4	55.2
519-524	Alsike Clover	Ithaca, Triangle Field	May 20,'43	3640.	128	14.8	57.0
525-530	Timothy	" " "	" " "	3660.	126	14.6	56.0
531-536	Alsike Clover	Ithaca, Triangle Field	May 20,'43	3680.	130	15.0	57.8
537-542	Timothy	" " "	" " "	3700.	128	14.8	56.8
543-548	Alsike Clover	Ithaca, Triangle Field	May 20,'43	3720.	132	15.2	58.6
549-554	Timothy	" " "	" " "	3740.	130	15.0	57.6
555-560	Alsike Clover	Ithaca, Triangle Field	May 20,'43	3760.	134	15.4	59.4
561-566	Timothy	" " "	" " "	3780.	132	15.2	58.4
567-572	Alsike Clover	Ithaca, Triangle Field	May 20,'43	3800.	136	15.6	60.2
573-578	Timothy	" " "	" " "	3820.	134	15.4	59.2
579-584	Alsike Clover	Ithaca, Triangle Field	May 20,'43	3840.	138	15.8	61.0
585-590	Timothy	" " "	" " "	3860.	136	15.6	60.0
591-596	Alsike Clover	Ithaca, Triangle Field	May 20,'43	3880.	140	16.0	61.8
597-602	Timothy	" " "	" " "	3900.	138	15.8	60.8
603-608	Alsike Clover	Ithaca, Triangle Field	May 20,'43	3920.	142	16.2	62.6
609-614	Timothy	" " "	" " "	3940.	140	16.0	61.6
615-620	Alsike Clover	Ithaca, Triangle Field	May 20,'43	3960.	144	16.4	63.4
621-626	Timothy	" " "	" " "	3980.	142	16.2	62.4
627-632	Alsike Clover	Ithaca, Triangle Field	May 20,'43	4000.	146	16.6	64.2
633-638	Timothy	" " "	" " "	4020.	144	16.4	63.2
639-644	Alsike Clover	Ithaca, Triangle Field	May 20,'43	4040.	148	16.8	65.0
645-650	Timothy	" " "	" " "	4060.	146	16.6	64.0
651-656	Alsike Clover	Ithaca, Triangle Field	May 20,'43	4080.	150	17.0	65.8
657-662	Timothy	" " "	" " "	4100.	148	16.8	64.8
663-668	Alsike Clover	Ithaca, Triangle Field	May 20,'43	4120.	152	17.2	66.6
669-674	Timothy	" " "	" " "	4140.	150	17.0	65.6
675-680	Alsike Clover	Ithaca, Triangle Field	May 20,'43	4160.	154	17.4	67.4
681-686	Timothy	" " "	" " "	4180.	152	17.2	66.4
687-692	Alsike Clover	Ithaca, Triangle Field	May 20,'43	4200.	156	17.6	68.2
693-698	Timothy	" " "	" " "	4220.	154	17.4	67.2
699-704	Alsike Clover	Ithaca, Triangle Field	May 20,'43	4240.	158	17.8	69.0
705-710	Timothy	" " "	" " "	4260.	156	17.6	68.0
711-716	Alsike Clover	Ithaca, Triangle Field	May 20,'43	4280.	160	18.0	69.8
717-722	Timothy	" " "	" " "	4300.	158	17.8	68.8
723-728	Alsike Clover	Ithaca, Triangle Field	May 20,'43	4320.	162	18.2	70.6
729-734	Timothy	" " "	" " "	4340.	160	18.0	69.6
735-740	Alsike Clover	Ithaca, Triangle Field	May 20,'43	4360.	164	18.4	71.4
741-746	Timothy	" " "	" " "	4380.	162	18.2	70.4
747-752	Alsike Clover	Ithaca, Triangle Field	May 20,'43	4400.	166	18.6	72.2
753-758	Timothy	" " "	" " "	4420.	164	18.4	71.2
759-764	Alsike Clover	Ithaca, Triangle Field	May 20,'43	4440.	168	18.8	73.0
765-770	Timothy	" " "	" " "	4460.	166	18.6	72.0
771-776	Alsike Clover	Ithaca, Triangle Field	May 20,'43	4480.	170	19.0	73.8
777-782	Timothy	" " "	" " "	4500.	168	18.8	72.8
783-788	Alsike Clover	Ithaca, Triangle Field	May 20,'43	4520.	172	19.2	74.6
789-794	Timothy	" " "	" " "	4540.	170	19.0	73.6
795-800	Alsike Clover	Ithaca, Triangle Field	May 20,'43	4560.	174	19.4	75.4
801-806	Timothy	" " "	" " "	4580.	172	19.2	74.4
807-812	Alsike Clover	Ithaca, Triangle Field	May 20,'43	4600.	176	19.6	76.2
813-818	Timothy	" " "	" " "	4620.	174	19.4	75.2
819-824	Alsike Clover	Ithaca, Triangle Field	May 20,'43	4640.	178	19.8	77.0
825-830	Timothy	" " "	" " "	4660.	176	19.6	76.0
831-836	Alsike Clover	Ithaca, Triangle Field	May 20,'43	4680.	180	20.0	77.8
837-842	Timothy	" " "	" " "	4700.	178	19.8	76.8
843-848	Alsike Clover	Ithaca, Triangle Field	May 20,'43	4720.	182	20.2	78.6
849-854	Timothy	" " "	" " "	4740.	180	20.0	77.6
855-860	Alsike Clover	Ithaca, Triangle Field	May 20,'43	4760.	184	20.4	79.4
861-866	Timothy	" " "	" " "	4780.	182	20.2	78.4
867-872	Alsike Clover	Ithaca, Triangle Field	May 20,'43	4800.	186	20.6	80.2
873-878	Timothy	" " "	" " "	4820.	184	20.4	79.2
879-884	Alsike Clover	Ithaca, Triangle Field	May 20,'43	4840.	188	20.8	81.0
885-890	Timothy	" " "	" " "	4860.	186	20.6	80.0
891-896	Alsike Clover	Ithaca, Triangle Field	May 20,'43	4880.	190	21.0	81.8
897-902	Timothy	" " "	" " "	4900.	188	20.8	80.8
903-908	Alsike Clover	Ithaca, Triangle Field	May 20,'43	4920.	192	21.2	82.6
909-914	Timothy	" " "	" " "	4940.	190	21.0	81.6
915-920	Alsike Clover	Ithaca, Triangle Field	May 20,'43	4960.	194	21.4	83.4
921-926	Timothy	" " "	" " "	4980.	192	21.2	82.4
927-932	Alsike Clover	Ithaca, Triangle Field	May 20,'43	5000.	196	21.6	84.2
933-938	Timothy	" " "	" " "	5020.	194	21.4	83.2
939-944	Alsike Clover	Ithaca, Triangle Field	May 20,'43	5040.	198	21.8	85.0
945-950	Timothy	" " "	" " "	5060.	196	21.6	84.0
951-956	Alsike Clover	Ithaca, Triangle Field	May 20,'43	5080.	200	22.0	85.8
957-962	Timothy	" " "	" " "	5100.	198	21.8	84.8
963-968	Alsike Clover	Ithaca, Triangle Field	May 20,'43	5120.	202	22.2	86.6
969-974	Timothy	" " "	" " "	5140.	200	22.0	85.6
975-980	Alsike Clover	Ithaca, Triangle Field	May 20,'43	5160.	204	22.4	87.4
981-986	Timothy	" " "	" " "	5180.	202	22.2	86.4
987-992	Alsike Clover	Ithaca, Triangle Field	May 20,'43	5200.	206	22.6	88.2
993-998	Timothy	" " "	" " "	5220.	204	22.4	87.2
999-1004	Alsike Clover	Ithaca, Triangle Field	May 20,'43	5240.	208	22.8	89.0
1005-1010	Timothy	" " "	" " "	5260.	206	22.6	88.0
1011-1016	Alsike Clover	Ithaca, Triangle Field	May 20,'43	5280.	210	23.0	89.8
1017-1022	Timothy	" " "	" " "	5300.	208	22.8	88.8
1023-1028	Alsike Clover	Ithaca, Triangle Field	May 20,'43	5320.	212	23.2	90.6
1029-1034	Timothy	" " "	" " "	5340.	210	23.0	89.6
1035-1040	Alsike Clover	Ithaca, Triangle Field	May 20,'43	5360.	214	23.4	91.4
1041-1046	Timothy	" " "	" " "	5380.	212	23.2	90.4
1047-1052	Alsike Clover	Ithaca, Triangle Field	May 20,'43	5400.	216	23.6	92.2
1053-1058	Timothy	" " "	" " "	5420.	214	23.4	91.2
1059-1064	Alsike Clover	Ithaca, Triangle Field	May 20,'43	5440.	218	23.8	93.0
1065-1070	Timothy	" " "	" " "	5460.	216	23.6	92.0
1071-1076	Alsike Clover	Ithaca, Triangle Field	May 20,'43	5480.	220	24.0	93.8
1077-1082	Timothy	" " "	" " "	5500.	218	23.8	92.8
1083-1088	Alsike Clover	Ithaca, Triangle Field	May 20,'43	5520.	222	24.2	94.6
1089-1094	Timothy	" " "	" " "	5540.	220	24.0	93.6
1095-1100	Alsike Clover	Ithaca, Triangle Field	May 20,'43	5560.	224	24.4	95.4
1101-1106	Timothy	" " "	" " "	5580.	222	24.2	94.4
1107-1112	Alsike Clover	Ithaca, Triangle Field	May 20,'43	5600.	226	24.6	96.2
1113-1118	Timothy	" " "	" " "	5620.	224	24.4	95.2
1119-1124	Alsike Clover	Ithaca, Triangle Field	May 20,'43	5640.	228	24.8	97.0
1125-1130	Timothy	" " "	" " "	5660.	226	24.6	96.0
1131-1136	Alsike Clover	Ithaca, Triangle Field	May 20,'43	5680.	230	25.0	97.8
1137-1142	Timothy	" " "	" " "	5700.	228	24.8	96.8
1143-1148	Alsike Clover	Ithaca, Triangle Field	May 20,'43	5720.	232	25.2	98.6
1149-1154	Timothy	" " "	" " "	5740.	230	25.0	97.6
1155-1160	Alsike Clover	Ithaca, Triangle Field	May 20,'43	5760.	234	25.4	99.4
1161-1166	Timothy	" " "	" " "	5780.	232	25.2	98.4
1167-1172	Alsike Clover	Ithaca, Triangle Field	May 20,'43	5800.	236	25.6	100.2
1173-1178	Timothy	" " "	" " "	5820.	234	25.4	99.2
1179-1184	Alsike Clover	Ithaca, Triangle Field	May 20,'43	5840.	238	25.8	101.0
1185-1190	Timothy	" " "	" " "	5860.	236	25.6	100.0
1191-1196	Alsike Clover	Ithaca, Triangle Field	May 20,'43	5880.	240	26.0	101.8
1197-1202	Timothy	" " "	" " "	5900.	238	25.8	100.8
1203-1208	Alsike Clover	Ithaca, Triangle Field	May 20,'43	5920.	242	26.2	102.6
1209-1214	Timothy	" " "	" " "	5940.	240	26.0	101.6
1215-1220	Alsike Clover	Ithaca, Triangle Field	May 20,'43	5960.	244	26.4	103.4
1221-1226	Timothy	" " "	" " "	5980.	242	26.2	102.4
1227-1232	Alsike Clover	Ithaca, Triangle Field	May 20,'43	6000.	246	26.6	104.2
1233-1238	Timothy	" " "	" " "	6020.	244	26.4	103.2
1239-1244	Alsike Clover	Ithaca, Triangle Field	May 20,'43	6040.	248	26.8	105.0
1245-1250	Timothy	" " "	" " "	6060.	246	26.6	104.0
1251-1256	Alsike Clover	Ithaca, Triangle Field	May 20,'43	6080.	250	27.0	105.8
1257-1262	Timothy	" " "	" " "	6100.	248	26.8	104.8
1263-1268	Alsike Clover	Ithaca, Triangle Field	May 20,'43	6120.	252	27.2	106.6
1269-1274	Timothy	" " "	" " "	6140.	250	27.0	105.6
1275-1280	Alsike Clover	Ithaca, Triangle Field	May 20,'43	6160.	254	27.4	107.4
1281-1286	Timothy	" " "	" " "	6180.	252	27.2	106.4
1287-1292	Alsike Clover	Ithaca, Triangle Field	May 20,'43	6200.	256	27.6	108.2
1293-1298	Timothy	" " "	" " "	6220.	254	27.4	107.2
1299-1304	Alsike Clover	Ithaca, Triangle Field	May 20,'43	6240.	258	27.8	109.0
1305-1310	Timothy	" " "	" " "	6260.	256	27.6	108.0
1311-1316	Alsike Clover	Ithaca, Triangle Field	May 20,'43	6280.	260	28.0	109.8
1317-1322	Timothy	" " "	" " "	6300.	258	27.8	108.8
1323-1328	Alsike Clover	Ithaca, Triangle Field	May 20,'43	6320.	262	28.2	110.6
1329-1334	Timothy	" " "	" " "	6340.	260	28.0	109.6
1335-1340	Alsike Clover	Ithaca, Triangle Field	May 20,'43	6360.	264	28.4	111.4
1341-1346	Timothy	" " "	" " "	6380.	262	28.2	110.4
1347-1352	Alsike Clover	Ithaca, Triangle Field	May 20,'43	6400.	266	28.6	112.2
1353-1358	Timothy	" " "	" " "	6420.	264	28.4	111.2
1359-1364	Alsike Clover	Ithaca, Triangle Field	May 20,'43	6440.	268	28.8	113.0
1365-1370	Timothy	" " "	" " "	6460.	266	28.6	112.0
1371-1376	Alsike Clover	Ithaca, Triangle Field	May 20,'43	6480.	270	29.0	113.8
1377-1382	Timothy	" " "	" " "	6500.	268	28.8	112.8
1383-1388	Alsike Clover	Ithaca, Triangle Field	May 20,'43	6520.	272	29.2	114.6
1389-1394	Timothy	" " "	" " "	6540.	270	29.0	113.6
1395-1400	Alsike Clover	Ithaca, Triangle Field	May 20,'43	6560.	274	29.4	115.4
1401-1406	Timothy	" " "	" " "	6580.	272	29.2	114.4
1407-1412	Alsike Clover	Ithaca, Triangle Field	May 20,'43	6600.	276	29.6	116.2
1413-1418	Timothy	" " "	" " "	6620.	274	29.4	115.2
1419-1424	Alsike Clover	Ithaca, Triangle Field	May 20,'43	6640.	278	29.8	117.0
1425-1430	Timothy	" " "	" " "	6660.	276	29.6	116.0
1431-1436	Alsike Clover	Ithaca, Triangle Field	May 20,'43	6680.	280	30.0	117.8
1437-1442	Timothy	" " "	" " "	6700.	278	29.8	116.8
1443-1448	Alsike Clover	Ithaca, Triangle Field	May 20,'43	6720.	282	30.2	118.6
1449-1454	Timothy	" " "	" " "	6740.	280	30.0	117.6
1455-1460	Alsike Clover	Ithaca, Triangle Field	May 20,'43	6760.	284	30.4	119.4
1461-1466	Timothy	" " "	" " "	6780.	282	30.2	118.4
1467-1472	Alsike Clover	Ithaca, Triangle Field	May 20,'43	6800.	286	30.6	120.2
1473-1478	Timothy	" " "	" " "	6820.	284	30.4	119.2
1479-1484	Alsike Clover	Ithaca, Triangle Field	May 20,'43	6840.	288	30.8	121.0
1485-1490	Timothy	" " "	" " "	6860.	286	30.6	120.0
1491-1496	Alsike Clover	Ithaca, Triangle Field	May 20,'43	6880.	290	31.0	121.8
1497-1502	Timothy	" " "	" " "	6900.	288	30.8	120.8
1503-1508	Alsike Clover	Ithaca, Triangle Field	May 20,'43	6920.	292	31.2	122.6
1509-1514	Timothy	" " "	" " "	6940.	290	31.0	121.6
1515-1520	Alsike Clover	Ithaca, Triangle Field	May 20,'43	6960.	294	31.4	123.4
1521-1526	Timothy	" " "	" " "	6980.	292	31.2	122.4
1527-1532	Alsike Clover	Ithaca, Triangle Field	May 20,'43	7000.	296	31.6	124.2
1533-1538	Timothy	" " "	" " "	7020.	294	31.4	123.2
1539-1544	Alsike Clover	Ithaca, Triangle Field	May 20,'43	7040.	298	31.8	125.0
1545-1550	Timothy	" " "	" " "	7060.	296	31.6	124.0
1551-1556	Alsike Clover	Ithaca, Triangle Field	May 20,'43	7080.	300	32.0	125.8
1557-1562	Timothy	" " "	" " "	7100.	298	31.8	124.8
1563-1568	Alsike Clover	Ithaca, Triangle Field	May 20,'43	7120.	302	32.2	126.6
1569-1574	Timothy	" " "	" " "	7140.	300	32.0	125.6
1575-1580	Alsike Clover	Ithaca, Triangle Field	May 20,'43	7160.	304	32.4	127.4
1581-1586	Timothy	" " "	" " "	7180.	302	32.2	126.4
1587-1592	Alsike Clover	Ithaca, Triangle Field	May 20,'43	7200.	306	32.6	128.2
1593-1598	Timothy	" " "	" " "	7220.	304	32.4	127.2
1599-1604	Alsike Clover	Ithaca, Triangle Field	May 20,'43	7240.	308	32.8	129.0
1605-1610	Timothy	" " "	" " "	7260.	306	32.6	128.0
1611-1616	Alsike Clover	Ithaca, Triangle Field	May 20,'43	7280.	310	33.0	129.8
1617-1622	Timothy	" " "	" " "	7300.	308	32.8	128.8
1623-1628	Alsike Clover	Ithaca, Triangle Field	May 20,'43	7320.	312	33.2	130.6
1629-1634	Timothy	" " "	" " "	7340.	310	33.0	129.6
1635-1640	Alsike Clover	Ithaca, Triangle Field	May 20,'43	7360.	314	33.4	131.4
1641-1646	Timothy	" " "	" " "	7380.	312	33.2	130.4
1647-1652	Alsike Clover	Ithaca, Triangle Field	May 20,'43	7400.	316	33.6	132.2
1653-1658	Timothy	" " "	" " "	7420.	314	33.4	131.2
1659-1664	Alsike Clover	Ithaca, Triangle Field	May 20,'43	7440.	318	33.8	133.0
1665-1670	Timothy	" " "	" " "	7460.	316	33.6	132.0
1671-1676	Alsike Clover	Ithaca, Triangle Field	May 20,'43	7480.	320	34.0	133.8
1677-1682	Timothy	" " "	" " "	7500.	318	33.8	132.8
1683-1688	Alsike Clover	Ithaca, Triangle Field	May 20,'43	7520.	322	34.2	134.6
1689-1694	Timothy	" " "	" " "	7540.	320	34.0	133.6
1695-1700	Alsike Clover	Ithaca, Triangle Field	May 20,'43	7560.	324	34.4	135.4
1701-1706	Timothy	" " "	" " "	7580.	322	34.2	134.4
1707-1712	Alsike Clover	Ithaca, Triangle Field	May 20,'43	7600.	326	34.6	136.2
1713-1718	Timothy	" " "	" " "	7620.	324	34.4	135.2
1719-1724	Alsike Clover	Ithaca, Triangle Field	May 20,'43	7640.	328	34.8	137.0
1725-1730	Timothy	" " "	" " "	7660.	326	34.6	136.0
1731-1736	Alsike Clover	Ithaca, Triangle Field	May 20,'43	7680.	330	35.0	137.8
1737-1742	Timothy	" " "	" " "	7700.	328	34.8	136.8
1743-1748	Alsike Clover	Ithaca, Triangle Field	May 20,'43	7720.	332	35.2	138.6
1749-1754	Timothy	" " "	" " "	7740.	330	35.0	137.6
1755-1760	Alsike Clover	Ithaca, Triangle Field	May 20,'43	7760.	334	35.4	139.4
1761-1766	Timothy	" " "	" " "	7780.	332	35.2	138.4
1767-1772	Alsike Clover	Ithaca, Triangle Field	May 20,'43	7800.	336	35.6	140.2
1773-1778	Timothy	" " "	" " "	7820.	334	35.4	139.2
1779-1784	Alsike Clover	Ithaca, Triangle Field	May 20,'43	7840.	338	35.8	141.0
1785-1790	Timothy	" " "	" " "	7860.	336	35.6	140.0
1791-1796	Alsike Clover	Ithaca, Triangle Field	May 20,'43	7880.	340	36.0	141.8
1797-1802	Timothy	" " "	" " "	7900.	338	35.8	140.8
1803-1808	Alsike Clover	Ithaca, Triangle Field	May 20,'43	7920.	342	36.2	142.6
1809-1814	Timothy	" " "	" " "	7940.	340	36.0	141.6
1815-1820	Alsike Clover	Ithaca, Triangle Field	May 20,'43	7960.	344	36.4	143.4
1821-1826	Timothy	" " "	" " "	7980.	342	36.2	142.4
1827-1832	Alsike Clover	Ithaca, Triangle Field	May 20,'43	8000.	346	36.6	144.2
1833-1838	Timothy	" " "	" " "	8020.	344	36.4	143.2
1839-1844	Alsike Clover	Ithaca, Triangle Field	May 20,'43	8040.	348	36.8	145.0
1845-1850	Timothy	" " "	" " "	8060.	346	36.6	144.0
1851-1856	Alsike Clover	Ithaca, Triangle Field	May 20,'43	8080.	350	37.0	145.8
1857-1862	Timothy	" " "	" " "	8100.	348	36.8	144.8
1863-1868	Alsike Clover	Ithaca, Triangle Field	May 20,'43	8120.	352	37.2	146.6
1869-1874	Timothy	" " "	" " "	8140.	350	37.0	145.6
1875-1880	Alsike Clover	Ithaca, Triangle Field	May 20,'43	8160.	354	37.4	147.4
1881-1886	Timothy	" " "	" " "	8180.	352	37.2	146.4
1887-1892	Alsike Clover

Copper teams up with iron and assists in hemoglobin formation. Its absence causes anemia. Copper deficiencies have been found in certain areas such as Florida. The copper problem needs further study regarding proper dosages since high intakes are toxic.

Manganese shortages are associated with slipped tendon in chicks and impaired reproduction in other animals along with slow growth of young. Manganese deficiency is complicated by the need of two of the B Complex vitamins for assimilation. The requirements have been fixed only for poultry. It is almost impossible to deplete large domestic animals of their manganese stores.

A deficiency of zinc is associated with poor fur development and slow growth in young. The common foods of man and animals are very seldom low in zinc.

On this ranch where two fall and one spring samplings have been made, the findings indicate that these trace minerals studied do not weather and leach to any extent between fall and spring.

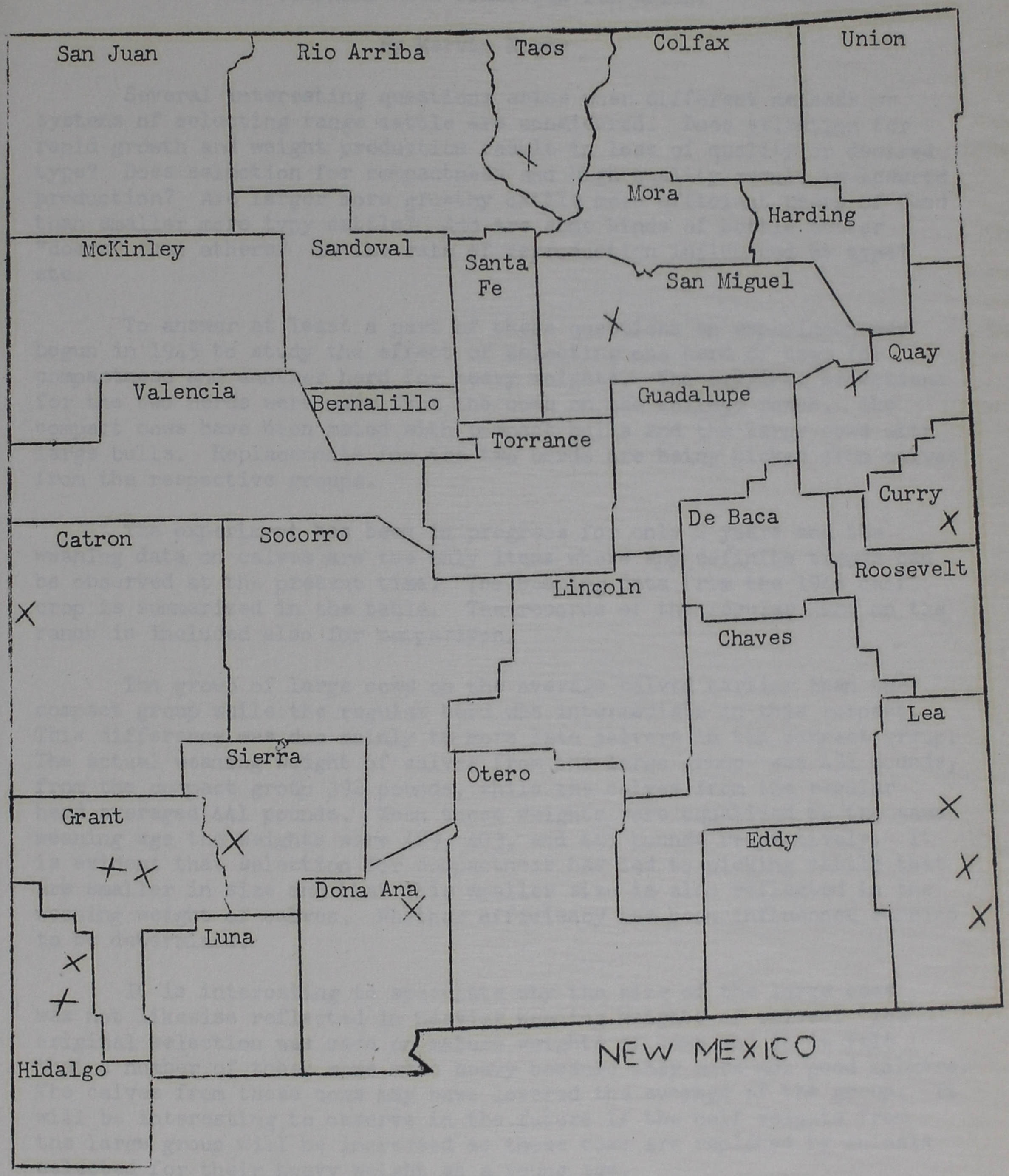
On the accompanying map of New Mexico the areas sampled are indicated. Some areas have not been surveyed. The results are considered indications and the study will continue until the state is more thoroughly sampled. Other areas should be sampled and other elements should be included. We will continue to explore this field and release the results as soon as we find them.

Where these mineral deficiencies occur, they hit with a wallop. In Wisconsin in a flock of 1,300 ewes and lambs, all but 200 died of cobalt deficiency between lambing season and fall.

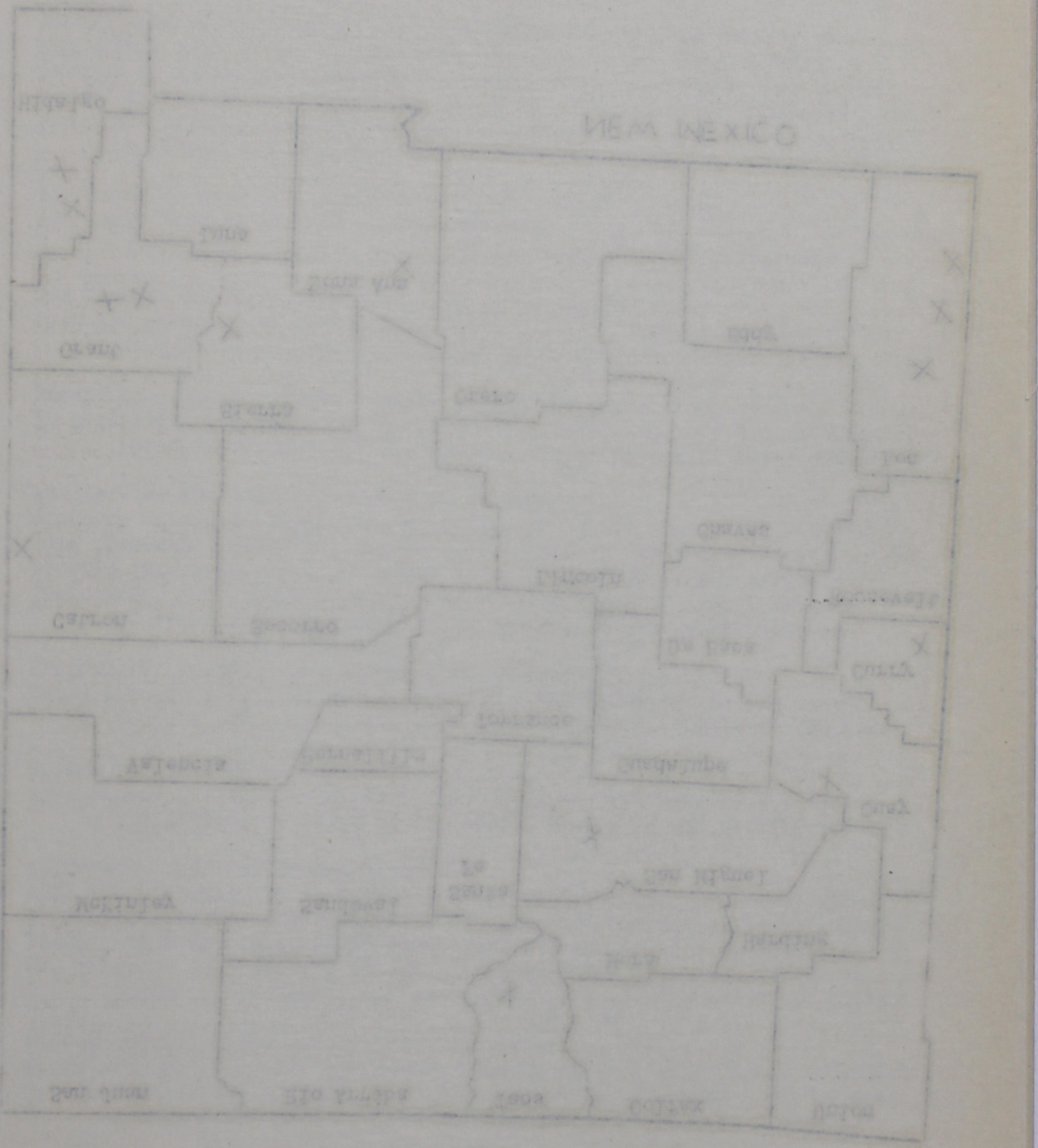
In Texas the feeding of a calcium phosphorus mineral mixture with the addition of manganese, copper, cobalt, zinc, and boron did not produce noticeable results with range cattle.

The results from 14 different areas of New Mexico indicate that the range grasses are not low in manganese cobalt and copper. The zinc situation in Dona Ana County seems satisfactory.

Stockmen are usually very much concerned lest they are not doing the right thing by their livestock. From the indications so far in this study, there seems to be little chance of benefits for livestock by the feeding of these minor minerals in these areas. The fact that cobalt and copper seem to be consistently adequate in the areas studied provides an opportunity to make a satisfactory mineral feed at less expense.



NEW MEXICO AREAS SAMPLED IN MINOR MINERAL ANALYSES



PROGRESS REPORT ON A STUDY OF SELECTION OF RANGE CATTLE FOR TYPE COMPARED WITH SELECTION FOR WEIGHT

By Marvin Koger

Several interesting questions arise when different methods or systems of selecting range cattle are considered. Does selection for rapid growth and weight production result in loss of quality or desired type? Does selection for compactness and high quality result in lowered production? Are larger more growthy cattle more efficient users of feed than smaller more typy cattle? And are some kinds of cattle better "doers" than others? Is the rate of reproduction influenced by type? etc.

To answer at least a part of these questions an experiment was begun in 1945 to study the effect of selecting one herd of cows for compactness and another herd for heavy weights. The original selections for the two herds were made from the cows on the college ranch. The compact cows have been mated with compact bulls and the large cows with large bulls. Replacements for the two herds are being picked from calves from the respective groups.

The experiment has been in progress for only 2 years and the weaning data on calves are the only items where any definite trends can be observed at the present time. The weaning data from the 1946 calf crop is summarized in the table. The records of the regular herd on the ranch is included also for comparison.

The group of large cows on the average calved earlier than the compact group while the regular herd was intermediate in this respect. This difference was due mainly to more late calvers in the compact group. The actual weaning weight of calves from the large group was 431 pounds, from the compact group 392 pounds, while the calves from the regular herd averaged 441 pounds. When these weights were equalized to the same weaning age the weights were 429, 403, and 445 pounds respectively. It is evident that selection for compactness has led to picking cattle that are smaller in size and that this smaller size is also reflected in the weaning weight of calves. Whether efficiency has been influenced remains to be determined.

It is interesting to speculate why the size of the large cows was not likewise reflected in heavier weaning weights of calves. The original selection was made on mature weights of cows and it is felt that a number of these cows were heavy because they were not good milkers. The calves from these cows may have lowered the average of the group. It will be interesting to observe in the future if the calf weights from the large group will be increased as these cows are replaced by animals selected for their heavy weight at a young age.

The grades of calves produced by the groups did not vary as much as did weight. The grades from the large and regular herds was half way between that of B plus (100) and A minus (110). The grades from the compact group averaged A minus.

Additional information on the 1947 calf crop will be supplied on Ranch Day.

PRODUCTION OR LARGE AND COMPACT CATTLE
COMPARED WITH THAT OF THE REGULAR HERD IN 1946

Kind of cattle	Large	Compact	Regular
Average weight of cows, pounds	1,085	895	1,004
Age of calves at weaning, days	207	196	202
Weaning weight of calves, pounds	431	392	441
Weaning weight adjusted to same age, pounds	429	403	445
Average grade of calves, score[1]	105	109	106

1/ The calves were graded from A plus down to C minus. B plus was assigned a score of 100, A minus, a score of 110, etc.

SUPPLEMENTS FOR COWS ON SPRING RANGE

By J. H. Knox

During late winter and spring our principal range grasses lose much of their nutrients. In the absence of palatable browse and new growth in the form of annual weeds, which occurs under favorable moisture conditions, range feed may be seriously lacking in the nutrients needed by breeding cows. This is especially true in the case of cows suckling calves or heavy with calf.

Many years spent on the analysis of forage and in conducting feeding experiments have shown that phosphorus is one nutrient which is nearly always deficient at this time. Since this problem has been quite thoroughly studied, it was removed from this experiment by feeding a mineral supplement to all the cows. Other nutrients which may be lacking are carbohydrates which provide energy, protein, and vitamin "A."

In 1945 an experiment was planned to test the advantage of providing each of these nutrients. Ninety-six cows were to be placed in one pasture about 1 month before the start of calving season. They consisted of four uniform groups of 24 each. The group known as Lot 1 was to receive no supplemental feed other than the salt mineral mixture available to all the cows. Lot II would be fed ground kafir as a source of carbohydrates or energy. Lot III would get cottonseed cake which would provide protein as well as energy equal to that fed Lot II. The last lot, number IV, was to receive a mixture of 70 percent cottonseed meal, 23 percent dehydrated alfalfa meal, and 7 percent molasses to provide energy, protein, and vitamin "A"; the latter coming from the alfalfa meal. In order to supply as much energy as was received by Lot II and as much protein as was fed to Lot III it was necessary to feed a little more of this mixture than the kafir and cake fed to Lots II and III respectively.

Any improvement of Lot II over Lot I should be due to supplying more energy, while the advantage of Lot III over II would be due to protein, and the increased production of Lot IV over Lot III would result from the vitamin "A" obtained from the alfalfa meal. At other times of year the cows were divided among the various pastures in such a manner that cows from each lot had the same treatment as those from the other lots.

The results of the first year's feeding, done in 1946, are shown in Table 1. Feeding was started February 13, about 1 month before the beginning of calving. For the first month 1 pound daily per head was fed in Lots II and III and 1-1/4 pounds daily per head in Lot IV because of the slightly lower energy and protein content of the mixture as compared with the grain and cottonseed meal respectively. At the end of the first month or about the time the calving started the amount of feed was doubled.

Table I RECORD FOR 1946

	Lot I	Lot II	Lot III	Lot IV
Supplement used	None 1/	Ground kafir	43 pct. cottonseed cake	Cottonseed meal 2/ dehydrated alfalfa meal, and molasses
Number of cows	24	24	24	24
Amount fed Feb. 13 to May 7, lbs.	-	138	137	173
Av. loss of weight while calving to May 7, lbs.	89	77	60	55
Av. gain in weight to Oct. 20, lbs.	3.9	4.9	-3.2	4.6
Number calves born	23	22	23	23
Number calves died	3/5	2	2	1
Number calves weaned	18	20	21	22
Av. weight of calves at weaning	416	413	412	419
Av. production per cow, lbs.	312	344	361	386

1/ A mixture of bone black and salt was available to all cows.
2/ 70 percent cottonseed meal, 23 percent dehydrated alfalfa meal, 7 percent molasses.
3/ Two calves died from accidental causes.

The effect of feeding on the loss of weight by the cows during the calving season is plainly shown. There seems to be a slight advantage for the higher protein supplements used in Lots III and IV. The 5 pound advantage of Lot IV over III is too small to prove a benefit from feeding vitamin "A" unless it is followed by more substantial differences in later years. Any advantage from feeding shown in the weights of cows or calves had disappeared by weaning time. The loss of weight in Lot III was due to one cow that shrank heavily due to a severe cancer eye. Several calves died in Lot I, resulting in a low production per cows. One of these calves was struck by lightning and another died as the result of difficulty at birth which could not be attributed to a lack of feed. In view of these circumstances, it is doubtful if significance can be attached to the resulting lower production in the non-fed lot.

The results of 1947 feeding are shown in Table 2. The plan of feeding was the same as in the previous year except that 1-1/8 pounds of the mixture was fed in Lot 4 for each pound of grain or cottonseed cake fed in the other lot instead of 1-1/4 pounds as was the case in 1946. Due to heavy rains late the previous fall, spring feed conditions were good as is shown by the unusually small loss of weight during calving. The cows in the fed lots lost less than those in the unfed lot as was true the previous year. There were slight signs in calf weights of benefits from the higher protein feed used in Lots III and IV, but no evidence of gain from feeding vitamin "A."

Table II RESULTS OF SECOND FEEDING SEASON
Feb. 11 to May 13, 1947

Supplement used	None	Ground kafir	Cottonseed cake	Cottonseed meal dehydrated alfalfa meal and molasses
Number of cows	24	24	24	24
Supplement fed per head, lbs.	0	154	153	176
Av. loss in weight, lbs.	45	7	2	9
Calves born	21	22	22	23
Calves died	1	1	2	2
Av. weight of calves, lbs.	133	133	144	141

A bonemeal and salt mixture was available to all the cattle.

In summary it may be said that it is too early to draw conclusions concerning this experiment. While the results to date show little advantage from feeding, it should be noted that the past two springs have been more favorable than average. The gain from feeding and especially the gain from the mixture used in Lot IV may be greater in less favorable years.

Table II RESULTS OF SECOND FEEDING SEASON
Feb. 11 to May 13, 1947

Supplement used	None	Ground kafir	Cottonseed cake	Cottonseed meal and molasses	Cottonseed meal dehydrated alfalfa meal and molasses
Number of cows	24	24	24		24
Supplement fed per head, lbs.	0	154	153		176
Av. loss in weight, lbs.	45	7	2		9
Calves born	21	22	22		23
Calves died	1	1	2		2
Av. weight of calves, lbs.	133	139	144		141

A boneneal and salt mixture was available to all the cattle.

In summary it may be said that it is too early to draw conclusions concerning this experiment. While the results to date show little advantage from feeding, it should be noted that the past two springs have been more favorable than average. The gain from feeding and especially the gain from the mixture used in Lot IV may be greater in less favorable years.

EFFECT OF THE PATTERN OF FORAGE UTILIZATION ON GRAZING CAPACITY

By K. A. Valentine

Much work has been done toward determination of the degree of use which most of the important range grasses can and should receive in order that they maintain their stands in good productive condition. As a result it is known about what constitutes proper grazing use of these grasses. This does not cover the matter of proper use in full, however. It is common knowledge that vegetation is not used to the same degree throughout a pasture, except perhaps very small pastures. In the great majority of cases heavy or comparatively heavy use occurs around watering places and other places where stock congregate, with progressively lighter use as distance from water increases.

For some time this fact of decreasing use did not appear to present much of a problem. Those who were concerned with the study of grazing capacity appeared to feel that with adequate water development and stock management, utilization of forage would be nearly uniform for all practical purposes. Despite this feeling, however, a considerable decrease in use of outlying forage continued even on well watered rangeland under good stock handling practices. Others, perhaps less concerned with the matter of grazing capacity but more concerned with using the forage, may also have not felt that much of a problem existed. The forage was there whether near or far; it was a simple and easy matter to stock so as to make full use of it. The certain undesirable results of this practice may have been ignored or unrecognized. But neither of these viewpoints or practices changed the basic fact that use of vegetation by livestock is unavoidably lighter on outlying range areas than on areas close around water or other places of concentration.

As with most problems, the passage of time with continued observation and study has brought the solution. In this case it is the recognition of the unavoidability of decreased grazing use as distance from water increases, and taking of the fact into account in arriving at grazing capacity and the stocking of pastures. But again as with most problems, the solution of one is not final. Other related problems arise and the present case is no exception.

The new problem then has to do with the actual pattern of utilization that shall be obtained in a pasture in order to have the maximum amount of forage permanently available for livestock. As is well known, there is certain to be an overuse zone extending for some distance around water. This zone will be characterized by comparatively low forage production for the better forage yielding plants will be absent or nearly so, being replaced by poor or worthless plants. From this zone there will be a gradual improvement in range condition and forage production owing to the lighter use until an area is reached where the better plants dominate, inferior or worthless plants are not overabundant, and forage production is at a maximum for the site conditions. Beyond this area use is progressively lighter and, unless factors other than grazing use enter in to complicate things, range condition and forage production are good.

Now to the question of the utilization pattern, it is of course recognized by all that an overused, underproductive "sacrifice" zone will exist around water if any reasonable use is had of outlying range. Considerable difference of opinion may arise, however, as to the actual size that this zone should be allowed to take. Should it extend outward from water a half mile, 1 mile, 1-1/2 miles or more from water?

Before this can be answered it will be necessary to consider what degrees of use will be obtained at different distances from water. Now this will vary from one place to another depending on kind of forage plants, kind of soil, whether the range is level or rough, kind of livestock, season of use, etc. In our pastures, which as can be seen consist largely of open level black grama grassland on light sandy soils, the decrease in utilization of forage with distance is surprisingly rather sharp.

The figures in the following table illustrate the utilization pattern we obtain on the College Ranch. Each figure is an average of a number of observations made in Pasture No. 1 at the end of the grazing year in June 1944, with the exception of the figure for the 2 to 2-1/2 mile zone. No observations were made in this zone in 1944 and the figure shown is an estimate of the use obtained. Observations in other pastures and other years exhibit the same general trend and are all well represented by the values shown. You are, of course, all familiar with this trend as it is of practically universal occurrence on rangelands.

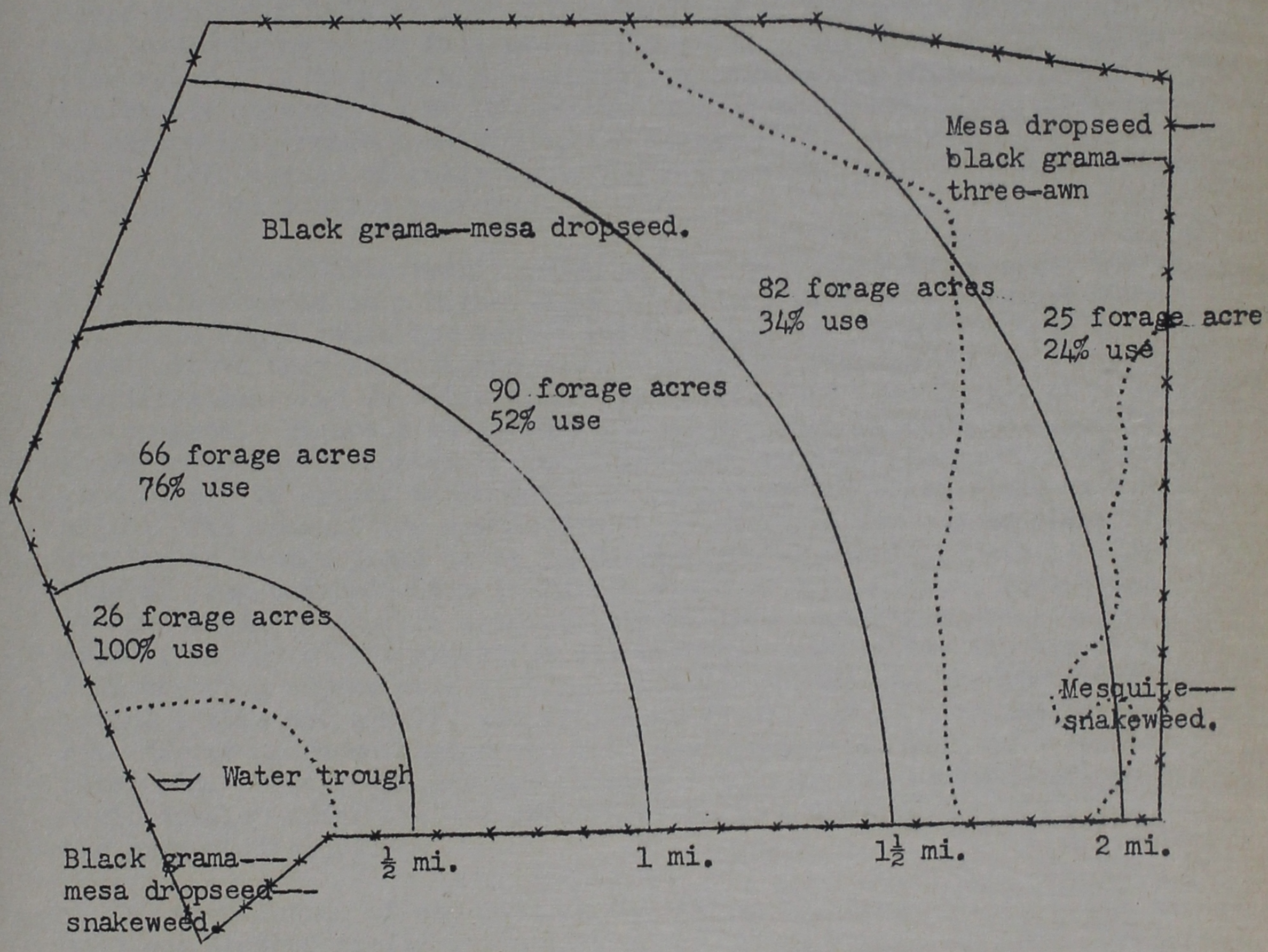
Distance from water	Percent Utilization of Forage (1)
0 - 1/2 mile	100
1/2 - 1 mile	76
1 - 1-1/2 miles	52
1-1/2 - 2 miles	34
2 - 2-1/2 miles	24

(1) Forage, as used here, is to be understood as the part of the vegetation that is properly usable, not the entire stand of vegetation.

We may now consider the grazing capacity that this pattern of use yields. In Figure 1, which is a map of the pasture mentioned, are shown the vegetation types and utilization zone at half mile intervals. Also shown for each zone are figures which give the total number of forage acres, a unit of forage yielded by grazing survey of the pasture, and the utilization of forage acres for each zone. It may be seen from the map that this pasture consists for the most part of good black grama rangeland. We passed through this pasture on our way to Camp Well, our last stop, and you will remember, too, that it is a well preserved, productive range area. The sacrifice zone around water is rather small, extending out only about a quarter mile from water. Immediately beyond this, a good forage stand occurs and a high, if not full, degree of use is made of it.

Figure 1. Map of Pasture No. 1 showing the different vegetation types in the pasture, utilization zones at half mile intervals around water and forage acres[1] and percent use of forage acres in the different zones, with 100% use extending out ½ mile from water.

1/ A forage acre is a unit of forage obtained by range survey. Density of the vegetation stand, its composition and the forage value of the constituent species are the factors which go into the determination of forage acre values.



Compilation of map data:

Distance from water	Forage Acres	Use	Forage Acres x Use
0 to ½ mile	26	100%	26
½ to 1 mile	66	76%	50
1 to 1½ mile	90	52%	47
1½ to 2 miles	82	34%	28
2 to 2½ miles	25	24%	6
		Total	157

$$\text{Animal Units} = \frac{157 \text{ (forage acres)}}{6.5 \text{ (forage acres per animal unit)}}$$
$$= 24$$

The table below the map is a summary of the data presented on the map and a computation of grazing capacity. The result of the computation is 24 animal units. It might be said in passing that this figure comes from a survey made in 1938 and possibly reflects somewhat the loss of vegetation and capacity sustained in the drought of 1934. Figures from more recent utilization surveys indicated a present capacity of about 35 animal units. In our computations we consider a 1,000-pound cow with her calf as an animal unit.

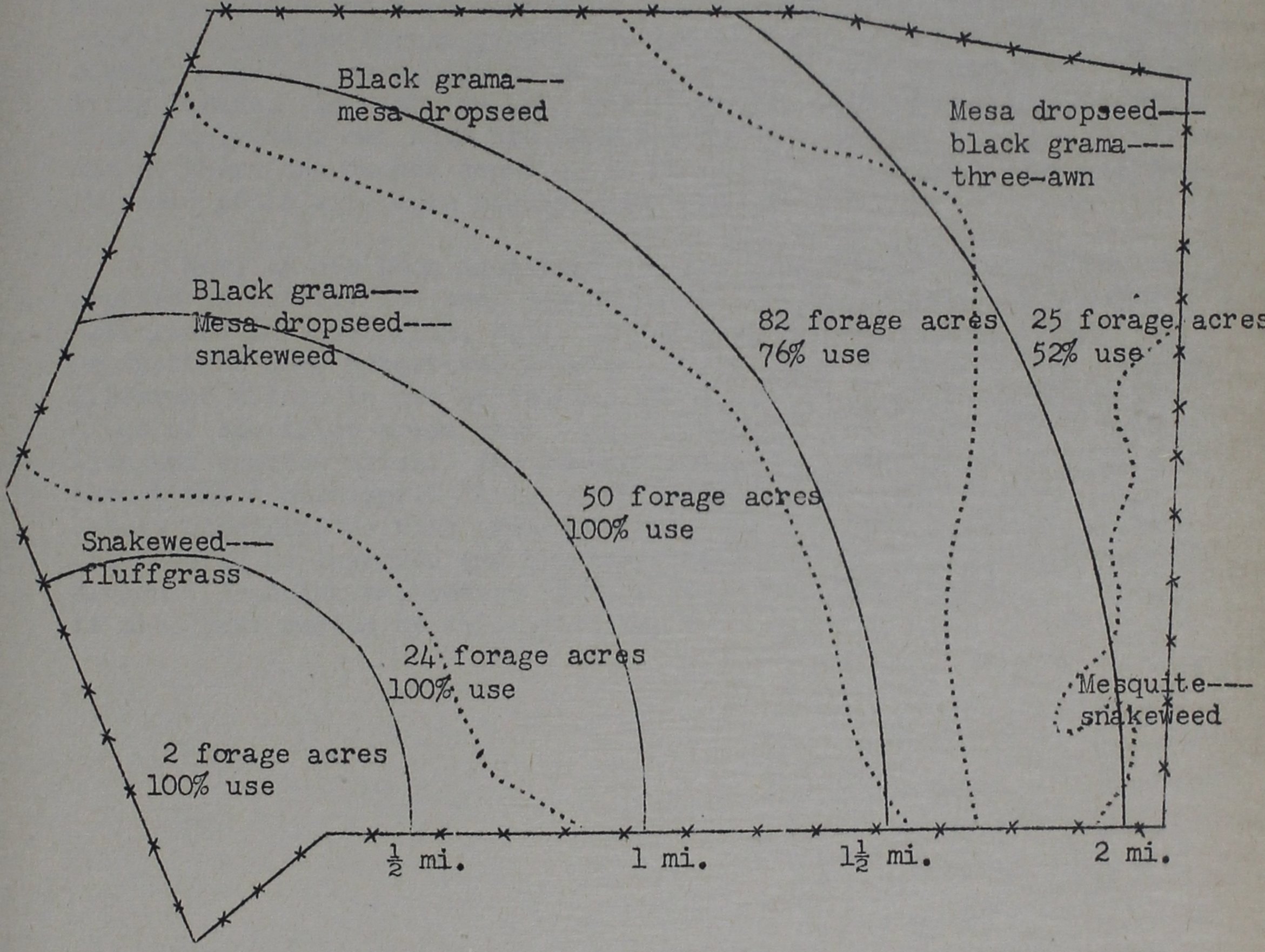
Now, would the grazing capacity be greater if full possible use were made of the forage at a considerably greater distance--say a mile and a half from water, to set up a specific case. This would certainly bring a much larger area of the pasture under full use of forage. But area alone does not make grazing capacity. Kind and amount of vegetation are the real factors that go to make grazing capacity. We have never subjected this or any of our pastures to the level of stocking that would bring about full use of forage at a distance of 1-1/2 miles from water. It is possible, however, by considering what we have repeatedly observed to be the general relationship between utilization of vegetation, range conditions, and forage yield, to draw a picture with a fair degree of reliability for our present purpose of the effect of such a utilization pattern.

An unavoidable result of an attempt to obtain 100 percent use at 1-1/2 miles would be a higher degree and more extensive over use closer in. This would cause the better forage plants to disappear from a larger area just as they have disappeared or begun to disappear from the present sacrifice zone and we would simply have very much less forage to use fully on the area. Figure 2 is another map of the same pasture on which is shown an approximation of the modifications in vegetation which we have good reason to expect would develop under a system of full use to 1-1/2 miles. The area of the extended zone of heaviest use and greatest reduction in forage yield is an approximation, of course. This is also true of area and reduction in forage yield of the adjacent zone which we have shown to exhibit some decline in range condition and forage production due to the excessive use brought about by the attainment of full use even beyond at a distance of 1-1/2 miles. In the two zones beyond a mile and a half, use of forage is assumed to decrease in the same degree as shown beyond the full use boundary at half mile in the first map. This again may not exactly represent the conditions that would develop under the use pattern assumed, but it will satisfy for the present discussion.

Compilation of the data on the map in the same way the first map data was handled yields a capacity of 23 animal units. Now the fact that the second computation shows a decrease of one animal unit is not at all important. It is based only on an approximation of the condition that would develop. There might very well have been an actual slight increase in grazing capacity as a result of extending the sacrifice zone. However, we would have to consider very seriously the real worth of such an increase, what the factors of increased walking between water and forage less concentration of livestock and possible increase in poisonous plants on the sacrifice area would have on gains, calf crops, and death loss. It is quite possible that extending the full use zone out to a mile instead of a mile and a half might have shown a worthwhile increase in grazing capacity from a similar computation. It is almost certain that extending it 2 miles would bring about a marked decrease in grazing capacity.

Figure 2. Map of Pasture No. 1 showing the different vegetation types in the pasture, utilization zones at half-mile intervals around water and forage acres[1] and percent of use of forage acres in the different zones, with 100% use extending out 1-1/2 mile from water.

1/ A forage acre is a unit of forage obtained by range survey. Density of the vegetation stand, its composition and the forage value of the constituent species are the factors which go into the determination of forage acre values.



Compilation of map data:

Distance from water	Forage Acres	Use	Forage Acres x Use
0 to ½ mile	2	100%	2
½ to 1 mile	24	100%	24
1 to 1½ miles	50	100%	50
1½ to 2 miles	82	76%	62
2 to 2½ miles	25	52%	13
		Total	151

$$\text{Animal Units} = \frac{151 \text{ (forage acres)}}{6.5 \text{ (forage acres per animal unit)}}$$

$$= 23$$

The important point in this comparison is that while a considerably larger area of range has been brought under 100 percent use, in the latter case, the reduction in forage yield accompanying the heavier-than-proper use of much of the area has resulted in a carrying capacity little different from what existed in the first condition.

It may be seen from these considerations that the pattern of grazing use that a pasture receives, through the effect of utilization on range condition and subsequent forage production, has a large influence on its grazing capacity. Here on the College Ranch we have adopted a pattern or standard of use that takes into consideration the inevitable facts that utilization must decrease as distance from water increases and that continued overuse will bring about poor range condition and low forage yield. We try to hold our sacrifice areas to a small size and we do not count on getting fullest possible use of outlying forage. In fact, we take the viewpoint that the outlying vegetation simply does not have the same forage value because of its location and we therefore do not count on it to carry the same grazing load that it could if it were more easily accessible from water.

Now, as has been indicated earlier, our results here cannot be applied in exactly the same way or degree in other parts of the state. Difference in vegetation, soil, topography, livestock management, etc., necessitate some departures from the values that we have found and use. Different values in use at various distances from water and different sizes of sacrifice areas have to be worked out through careful observation and consideration. The general principle, however, will hold for almost all conditions. It is our belief that working out stocking levels according to this principle will do much to improve range areas that should be improved and maintain those now in good productive condition. We think the matter of high production on a maintained basis is also best served by this practice.

A COMPARISON OF TEN YEARS' PRODUCTION FROM RANGE COWS AND YEARLING STEERS

By J. H. Knox

Since 1936 we have kept records on the production of the yearling steers and breeding cows on the ranch. We first became interested in yearlings because it seemed to us that they were making more money than anything else. We were also interested in them because they can always be sold. We believe this is important in the Southwest where rainfall is so uncertain. In the present boom time, almost any kind of cattle can be sold. But often during a drought in more normal times or in depression times, it is almost impossible to sell thin cows and their doggied calves. At such times steers may not weigh much, but they can be loaded on cars, sent to a central market and converted into cash when cash is needed most.

The results obtained from 1937 to 1946 inclusive are summarized in the accompanying table. We omitted the 1936 record because a poor calf crop that year made the record seem too favorable to the steers. The grazing season of 1947 had not been completed when this report was written.

The first part of the table gives the average weight gain made by the steers each year.

The second part gives the average production of the cows. This production is the result of multiplying the weaning weight of calves by the percent calf crop. For example, if the average weight of calves was 400 pounds and 90 percent of the cows had raised calves to weaning age, the production per cow would be 360 pounds.

The last part of the table, which compares steers to cows, needs more explanation. That first column, "production per head," means just what it says. On the 10-year average, a yearling gained 85.6 pounds for each 100 pounds produced by a cow. The last three columns are based not on what happened but on what we calculate happened. Naturally we could not measure how much feed the animals ate on the large semidesert pastures. So we calculated a relative feed consumption by adding the known amount of feed it takes to maintain animals of these sizes and weights and the known amount it takes to produce what these animals produced. By this method we found that the average steer for the 12 months after weaning ate about 65 percent as much as the average breeding cow, or that three steers ate about as much feed as two cows. What the average steer produced from the feed of the average cow is calculated by dividing his gain by the percent of the cow's feed he ate.

These calculations seem a little complicated, but the results are simple. A steer produced 85 percent as much beef as a range cow, but ate only 65 percent as much feed. This means the steer would produce 132 pounds in gain from the same amount of feed that a cow would need to produce 100 pounds in calf weight. Expressed another way, the average production per cow was 378 pounds, while yearling steers produced 499 pounds from a similar amount of feed.

The effect of the drought year of 1943 on the two classes of cattle is interesting. It looks, from the information given in the table, as if the immediate effect of the drought was greater on the production of the steers than on that of the cows. From a similar amount of feed the steers produced only 16 percent more than the cows, when for the 10 years they average 32 percent more. The cows may have been able to use a reserve stored from more favorable years in the past. However, drought of 1 year duration affects the production of cows the following year by reducing the calf crop. Yearling steers, on the other hand, make normal gains the year following the drought. When we average the 1943 and 1944 productions we find that the steers produced 42 percent more than the cows from the same amount of feed. The results might not be exactly the same in another case, but we believe they would be similar.

The question may be asked whether results would be the same on other ranges. The weight would be different, but we believe that a similar ratio between steers and cows usually would exist. Ranges that produce heavier calves would also produce heavier yearlings or the other way around. In some cases, where rough ranges are unsuitable for breeding or severe weather conditions increase losses at calving, results might be more favorable to the steers.

If our records mean what we believe they do, many ranchmen could increase their beef production and financial returns by replacing part of their cows with yearling steers. Such a plan, besides making better use of the feed, would also make it easier to adjust numbers to a varying feed supply.

PRODUCTION FROM YEARLING STEERS AND RANGE COWS

Year	Steers			Cows			Comparison of steers with cows			
	Weaning weight	Yearling weight	Gain	Calf crop	Weaning weight	Production per cow	Production per head	Calculated feed consumed per head	Calculated production from feed of one cow	Calculated production from feed of one cow
	Lbs.	Lbs.	Lbs.	Pct.	Lbs.	Lbs.	Pct.	Pct.	Lbs.	Pct.
1937	428	781	353	96	461	443	1/ 79.7	1/ 65	543	1/ 123
1938	488	801	313	92	421	387	80.9	68	460	119
1939	458	823	365	92	443	407	89.7	69	529	130
1940	442	786	344	88	434	382	90.1	68	506	132
1941	427	782	355	90	429	386	92.0	67	530	137
1942	443	807	364	90	456	410	88.8	68	535	130
1943	462	699	237	93	349	325	72.9	63	376	116
1944	331	694	363	84	406	343	105.8	63	576	168
1945	412	643	231	87	404	351	65.8	2/ 54	428	122
1946	398	724	326	85	423	360	90.6	64	509	141
AVG.	429	754	325	90	423	379	85.6	65	499	132

1/ Cows equal 100 percent.
2/ Steers removed one month early because of drought on their part of the range.